



TRIAL QUESTION PAPERS 2025 PAPER 2 DIFFERENT PROVINCES

SUBJECT : LIFE SCIENCES PAPER 1 PAST PAPERS

YEAR : 2025.

COMBINED BY : BAG OF HOPE ACADEMY

GRADE : 12

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GRADE 12

**CORRECTED LIFE SCIENCES P2
TRIAL EXAMINATION
MARKING GUIDELINE
2025**

MARKS: 146

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PRINCIPLES RELATED TO MARKING LIFE SCIENCES

1. **If more information than marks allocated is given**
Stop marking when maximum marks is reached and put a wavy line and 'max' in the right hand margin.
 2. **If, for example, three reasons are required and five are given**
Mark the first three irrespective of whether all or some are correct/incorrect.
 3. **If whole process is given when only part of it is required**
Read all and credit relevant part.
 4. **If comparisons are asked for and descriptions are given**
Accept if differences/similarities are clear.
 5. **If tabulation is required but paragraphs are given**
Candidates will lose marks for not tabulating.
 6. **If diagrams are given with annotations when descriptions are required**
Candidates will lose marks.
 7. **If flow charts are given instead of descriptions**
Candidates will lose marks.
 8. **If sequence is muddled and links do not make sense**
Where sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If sequence and links becomes correct again, resume credit.
- Non-recognized abbreviations**
9. Accept if first defined in answer. If not defined, do not credit the unrecognised abbreviation but credit the rest of answer if correct.
 10. **Wrong numbering**
If answer fits into the correct sequence of questions but the wrong number is given, it is acceptable.
 11. **If language used changes the intended meaning**
Do not accept.
 12. **Spelling errors**
If recognizable, accept, provided it does not mean something else in Life Sciences or if it is out of context.
 13. **If common names given in terminology**
Accept, provided it was accepted at the National memo discussion meeting.
 14. **If only letter is asked for and only name is given (and vice versa)**
No credit.

15. If units are not given in measurements

Memorandum will allocate marks for units separately, except where it is already given in the question.

16. Be sensitive to the sense of an answer, which may be stated in a different way.**17. Caption**

Credit will be given for captions to all illustrations (diagrams, graphs, tables, etc.) except where it is already given in the question.

18. Code-switching of official languages (terms and concepts)

A single word or two that appears in any official language other than the learners' assessment language used to the greatest extent in his/her answers should be credited, if it is correct. A marker that is proficient in the relevant official language should be consulted. This is applicable to all official languages.

SECTION A**QUESTION 1**

- 1.1 1.1.1 B✓✓
 1.1.2 C✓✓
 1.1.3 A✓✓
 1.1.4 D✓✓
 1.1.5 C✓✓
 1.1.6 B✓✓
 1.1.7 B✓✓
 1.1.8 D✓✓
 1.1.9 C✓✓
 1.1.10 D✓✓ (20)
- 1.2 1.2.1 Anaphase I✓
 1.2.2 Co-dominance✓
 1.2.3 Foramen magnum✓
 1.2.4 DNA Replication✓/ Replication
 1.2.5 Hypothesis✓
 1.2.6 Genetic engineering✓
 1.2.7 Phenotype✓
 1.2.8 Phylogenetic tree✓/ Cladogram
 1.2.9 Anticodons✓ (9)
- 1.3 1.3.1 B Only✓✓
 1.3.2 A Only✓✓
 1.3.3 A Only ✓✓ (6)
- 1.4 1.4.1 X = centromere✓
 Y = chiasma✓ / chiasmata (2)
 1.4.2 Ovary✓ (1)
 1.4.3 (a) Crossing over✓ (2)
 (b) Prophase I✓
 1.4.4 C → B → A ✓ (1)
 1.4.5 - Production of haploid gametes ✓
 - Halving effect of meiosis overcomes the doubling during fertilisation
 thus maintaining a constant chromosome number from one generation to the
 next ✓
 - Mechanism to introduce genetic variation through:
 • crossing over
 • The random arrangement of chromosomes at the equator✓ (3)
 (9)

- 1.5
- Both involve the division of a parent cell into daughter cells✓
 - Both processes include same basic stages: prophase, metaphase, anaphase, and telophase✓
 - DNA replicates once during the interphase before both processes begin✓
 - Both use spindle fibers to separate chromosomes or chromatids. ✓
- (Any 3) (3)**
- 1.6 1.6.1 Suspect 2 ✓ (1)
- 1.6.2
- Identification of relatives / tracing siblings/ missing persons✓
 - Paternity testing ✓
 - Diagnosis of genetic disorders✓
 - To determine matching tissues for organ transplants✓
 - Research into variation in populations✓
 - **Identify dead bodies** (2)
- (3)**
50
- (Mark the first two)

TOTAL QUESTION 1

SECTION B**QUESTION 2**

- 2.1 2.1.1 - DNA carries hereditary information✓
 - DNA contains coded information for protein synthesis✓
(Mark first ONE only) (1)

2.1.2 ACA ✓ (1)

2.1.3 Threonine✓; Cysteine✓
(must be in correct order) (2)

2.1.4 - Both ATG and ATA✓
 - Code for the same amino acid/tyrosine✓ so the protein is unchanged (2)
(6)

- 2.2 -Each tRNA carries a specific amino acid✓
 -When the anticodon on the tRNA✓
 -matches the codon on the mRNA✓
 -then tRNA brings the specific amino acid✓
 to the ribosome✓
 - Amino acids become attached to each other by peptide bonds✓
 - to form the required protein✓
(Any 5) (5)

- 2.3
- | Component | DNA | RNA |
|------------|-----------------------------|--------------------------|
| Sugar type | Contains Deoxyribose sugar✓ | Contains a Ribose sugar✓ |
- (1x2) and One for the table (3)**

- 2.4 2.4.1 - Fannie has short fingers and straight hair✓
 - Rose has normal fingers and curly hair✓ (2)

2.4.2 bH✓, bh✓ (If a learner wrote all the possible gametes, mark the first two only) (2)

- 2.4.3 Due to random arrangement of chromosomes at the equator ✓ during meiosis ✓ any one of the two alleles of a characteristic can sort with any one of another characteristic✓
 The alleles of different genes move independently ✓ of each other into the gametes ✓
 They can therefore appear in the gametes in different combinations: BH, Bh, bH, bh ✓
(4)
(8)

2.5	2.5.1	(a) $I^B I^B$ ✓ or $I^B i$ ✓	(2)
		(b) ii ✓✓	(2)
	2.5.2	I^A ✓ I^B ✓	(2)
	2.5.3	The baby's genotype is ii (blood group O), which requires two O alleles. ✓ Mr Mashilo has genotype AB and cannot contribute an O allele ✓ Therefore, he cannot be the biological father ✓	(3)
	2.5.4	Blood type can be used to exclude a particular man ✓ as the parent but it cannot confirm that a particular man is the father ✓ Since a large portion of the population have the same blood type ✓	(Any 2) (2)
			(11)
2.6		- Normal females have two X ✓ chromosomes - Normal males have one X and one Y ✓ - The female always provides X in the egg ✓ - If an egg cell is fertilized by an X bearing sperm ✓ a female/girl ✓ is formed - If an egg is fertilized by a Y bearing sperm ✓ - a male/boy ✓ is formed	(5)
2.7	2.7.1	(a) Female without haemophilia ✓	(1)
		(b) $X^H X^h$ ✓	(1)
	2.7.2	- Females have two X chromosomes ✓ - Females must inherit two copies of the recessive allele, X^h ✓ to be haemophiliac - Females who inherit only one of the recessive allele X^h, $X^H X^h$ are still not haemophiliac ✓	(3)
			(Any 3)

2.7.3

P₁ Phenotype Male without haemophilia x Haemophilic female ✓
 Genotype $X^H Y \times X^h X^h$ ✓

Meiosis
 G/gametes $X^H, Y \times X^h, X^h$ ✓

Fertilisation

F₁/F₂ Genotype $X^H X^h, X^H X^h, X^h Y, X^h Y$ ✓
 Phenotype **2 unaffected daughters : 2 haemophilic sons** ✓

*50% ✓ chance of having a haemophilic son but 100% if it is a son

P₁ and F₁ ✓
 Meiosis and fertilisation ✓

*1 compulsory + any 6

OR

P₁ Phenotype Male without haemophilia x Haemophilic female ✓
 Genotype $X^H Y \times X^h X^h$ ✓

Meiosis
 Fertilisation

Gametes	X^h	X^h
X^H	$X^H X^h$	$X^H X^h$
Y	$X^h Y$	$X^h Y$

1 mark for correct gametes
 1 mark for correct genotypes

F₁ Phenotype **2 unaffected daughters : 2 haemophilic sons** ✓

*50% ✓ chance of having a haemophilic son but 100% if it is a son

P₁ and F₁ ✓
 Meiosis and fertilisation ✓

*1 compulsory + any 6

(7)

(12)

QUESTION 3

3.1 3.1.1 Naturally resistant means that due to natural genetic variation, some pathogens already have traits✓ that allow them to survive exposure to drugs or pesticides without needing to develop resistance later. (1)

3.1.2 When drugs or pesticides are used, they kill non-resistant pathogens✓, leaving only the naturally resistant ones. According to Darwin's principle of natural selection, individual with resistant alleles will survive✓, reproduce✓ and pass on the allele for resistance trait to their offspring✓, gradually leading to a better-adapted population✓. (3)

(Mark any three)

3.2 3.2.1 A possible conclusion from this investigation is that chickens bred for meat production gain weight significantly faster than those bred for egg-laying.✓✓ (2) (4)

OR

Chickens bred for meat production are heavier than those bred for egg-laying.✓✓

3.2.2 (a) Age/type of chickens✓ (1)

(b) Live weight✓ (1)

3.2.3 Use the same scale to weigh the chicks✓

-Weigh the same chicks at the same time✓

-Give the chicks same type of food✓

-Same amount of food✓

-Same feeding time✓

-Same age of chicks✓

-Same cages of the same size✓

-Same number of chicks in each sample group✓

(Mark first one only) (1)

3.2.4 $\left(\frac{2500-500}{500}\right) \times 100\checkmark = 400\%\checkmark$ (2)

3.2.5 Increase the reliability of the investigation✓✓ (2) (9)

3.3 3.3.1 (a) No evolutionary change takes place in phase A ✓ – the species is in equilibrium with its environment ✓ (2)

(b) Phase B points to an accelerated evolutionary change ✓ due to rapid environmental changes ✓ (2)

3.3.2 Punctuated equilibrium ✓ (1)

3.3.3 During phase B, species with favourable characteristics/ suitable to the new environment, survive and reproduce✓ species that do not have advantageous characteristics die out. Thus the chances of speciation during phase B are much greater than during phase A ✓ (2) (7)

- 3.4 3.4.1 A transitional fossil shows intermediate characteristics of two distinct species✓✓ (2)
- 3.4.2 - The foramen magnum is located more forward position✓, so that
 - the vertebral column extends beneath✓ the skull.
 - The spine is S-shaped ✓to
 - support an upright posture✓
 - The pelvis is shorter and wider✓
 - to support the body above✓the pelvis (6)
- 3.4.3 - There was a change in diet✓
 - from tough✓/raw to
 - softer✓/cooked food (3)
- 3.5 3.5.1 B✓ (11)
- 3.5.2 Taung Child✓
 Little foot✓
 Mrs Ples✓
 Karabo✓ (1)
- 3.5.3 Site 4✓ (Any 2) (2)
- 3.5.4 Mitochondrial DNA✓/mtDNA/genetic evidence✓ (2)
- 3.6 3.6.1 Similar organisms✓
 that can interbreed✓
 to produce fertile offspring✓ (3)

3.6.2 The process of speciation*✓ through a geographical isolation

If a population of a single species becomes separated by a separated
by a geographical barrier✓ (central valley)

Then the population splits into two✓, there is no gene flow between the
two populations✓

Since each population may be exposed to different environmental
conditions✓/the selection pressure may be different

Natural selection occurs independently in each of the two populations✓,
such that the individual of the two populations become different from
each other✓

Genotypically and phenotypically✓

Even if the two populations were to mix again✓, they will not be able to
interbreed✓

The two populations are now different species (6)

(Any 5 + 1 compulsory*)

3.6.3 Natural selection causes individuals with advantageous traits to survive
and reproduce ✓

Over time, isolated populations adapt to different environments ✓

This leads to the development of distinct traits ✓

Eventually, reproductive isolation results in speciation ✓

DO NOT CREDIT: THE QUESTION HAS BEEN REMOVED DUE TO TYPING
ERROR AND CONVERSION TABLE PROVIDED

(4)
(13)

TOTAL SECTION B: 96
GRAND TOTAL: 146



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GRADE 12

**LIFE SCIENCES P2
TRIAL EXAMINATION
SEPTEMBER 2025**

MARKS: 150

Time: 2½ hours

This question paper consists of 17 pages including the cover page

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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 must use a non-programmable calculator, protractor and a compass.
11. Write neatly and legibly.

SECTION A**QUESTION 1**

1.1. Various options are provided as possible answers to the following. Choose the correct answer and write only the letter (A - D) next to the question number (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11.D

1.1.1. A plant species has a diploid chromosome number of 24.
Which ONE of the following is the haploid chromosome number for this species?

- A 48
- B 12
- C 6
- D 36

1.1.2. A segment of DNA contains:

- 35% of adenine in strand 1
- 10% of cytosine in strand 2
- 25% of guanine in strand 2

In this segment of DNA, there will also be...

- A 35% of adenine in strand 2
- B 10% of cytosine in strand 1
- C 35% of thymine in strand 2
- D 25% of cytosine in strand 2

1.1.3. When a cell divides by meiosis it results in ...

- A Four haploid gametes.
- B Two diploid gametes.
- C Four haploid somatic cells.
- D Two haploid somatic cells.

1.1.4. An individual is heterozygous for a harmful recessive allele but unaffected by it. Which one of the following best represents the genetic composition of this individual?

- A One harmful recessive allele and one harmful dominant allele.
- B Two dominant harmless alleles.
- C One harmful dominant allele and one harmless recessive allele
- D One harmful recessive allele and one harmless dominant allele.

1.1.5. The insulin molecule contains 54 amino acids. How many mRNA nucleotides code for this insulin molecule?

- A 54
- B 18
- C 162
- D 153

1.1.6. During which stage of meiosis do spindle fibers begin to form?

- A Interphase
- B Prophase
- C Metaphase
- D Telophase

1.1.7. The following are characteristics of a group of animals:

- (i) Able to interbreed
- (ii) Occupy the same habitat
- (iii) Produce infertile offspring
- (iv) Belong to the same species

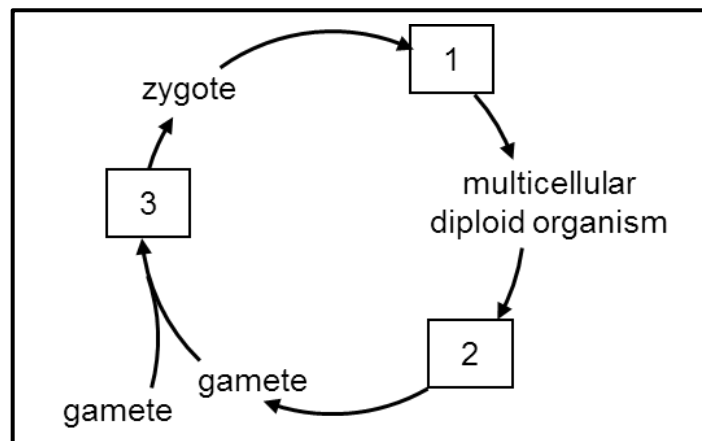
Which combination CORRECTLY represents a population?

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

1.1.8. The following represents the most significant evolutionary change in the development of *Homo sapiens*?

- A Loss of body hair.
- B Shortening of the jaws.
- C Shorter legs.
- D The increase in brain size.

1.1.9. Use the sketch below to identify processes 1, 2 and 3.



	1	2	3
A	meiosis	fertilisation	mitosis
B	fertilisation	mitosis	meiosis
C	mitosis	meiosis	fertilisation
D	fertilisation	meiosis	mitosis

1.1.10. Which ONE of the following statements is CORRECT for the 'Out of Africa' hypothesis?

- A All modern humans evolved from African apes and then migrated to other parts of the world.
- B An analysis of mutations on the mitochondrial DNA shows that the oldest male ancestors were found in Africa.
- C The youngest fossils of *Homo erectus* were found in Africa only.
- D All modern humans originated in Africa and migrated to other continents.

(10x2) (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 your ANSWER BOOK.

- 1.2.1. The phase of meiosis where the two chromosomes of each homologous pair are pulled to the opposite poles.
- 1.2.2. A genetic cross in which both alleles are equally expressed in the phenotype.
- 1.2.3. An opening on primate skulls through which the spinal cord passes.
- 1.2.4. The process during which a DNA molecule makes an exact copy of itself.
- 1.2.5. A testable statement that may be accepted or rejected.
- 1.2.6. An alteration of genetic make-up of an organism so that it fulfills some human needs
- 1.2.7. The external appearance of an individual determined by the DNA in the gene that influences a particular characteristic.
- 1.2.8. A diagrammatic representation showing the probable evolutionary relationship amongst different organisms
- 1.2.9. Triplets of bases found in a transfer RNA molecule

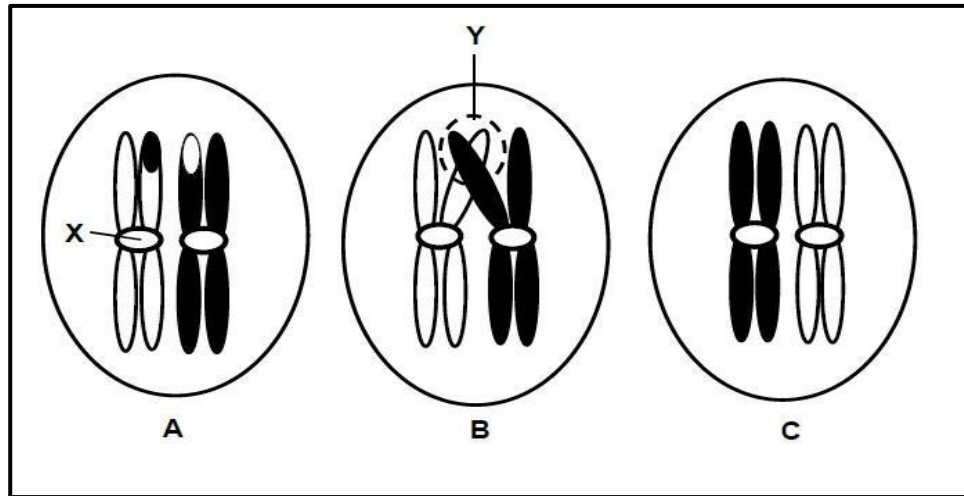
(9 x 1) **(9)**

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 number (1.3.1 to 1.3.3) in the ANSWER BOOK

	COLUMN I	COLUMN II
1.3.1.	Contains the sugar deoxyribose	A: RNA B: DNA
1.3.2.	Humans select characteristics when breeding organisms.	A: Artificial selection B: Natural selection
1.3.3.	Proposed the ideas of use and disuse, and the inheritance of modified characteristics to explain evolution	A: de Lamarck B: Charles Darwin

(3x2) **(6)**

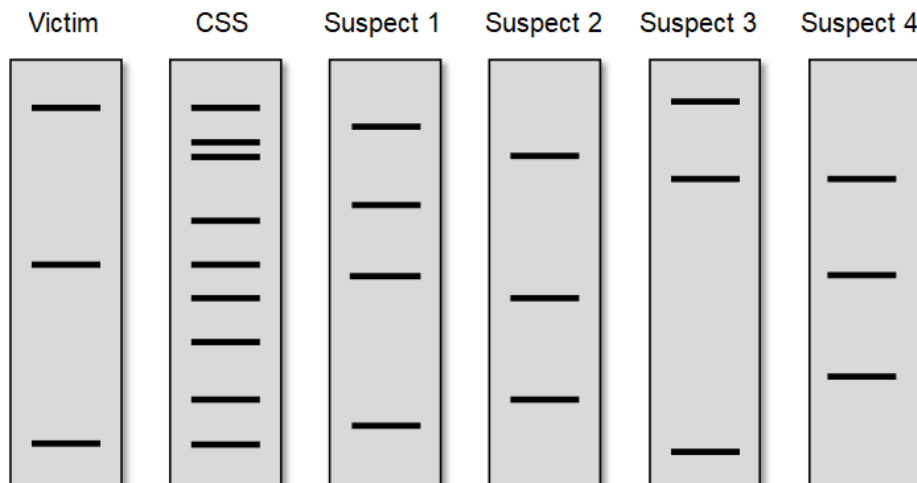
- 1.4. The diagrams below represent a chromosome pair in a female human cell. The cells (**A**, **B** and **C**) show different events in a phase of meiosis, which are not necessarily in the correct sequence.



- 1.4.1 Give labels for:
- Region X (1)
 - Area Y (1)
- 1.4.2. Name the organ in the human female where meiosis occurs. (1)
- 1.4.3. Name the:
- Process occurring in diagram B (1)
 - Phase represented by the diagrams above. (1)
- 1.4.4. Arrange letters **A**, **B** and **C** to show the correct sequence of the events. (1)
- 1.4.5. State three reasons why meiosis is biologically important. (3)

- 1.5 Give three similarities between mitosis and meiosis (3)
- (12)**

- 1.6 In a fight involving a number of people, one person was seriously injured. Police took blood samples from the victim, the crime scene (CSS - crime scene sample) and four suspects. The DNA was then extracted from each sample. The results are shown in the DNA profiles below



- 1.6.1 Which suspect probably injured the victim? (1)
- 1.6.2 Name two uses of DNA profiling other than for solving crime. (2)

(3)

TOTAL SECTION A: [50]

SECTION B**QUESTION 2**

- 2.1. The table below shows a partial DNA sequence from a human, as well as a codon table that can be used to determine which amino acids are required to make a protein.

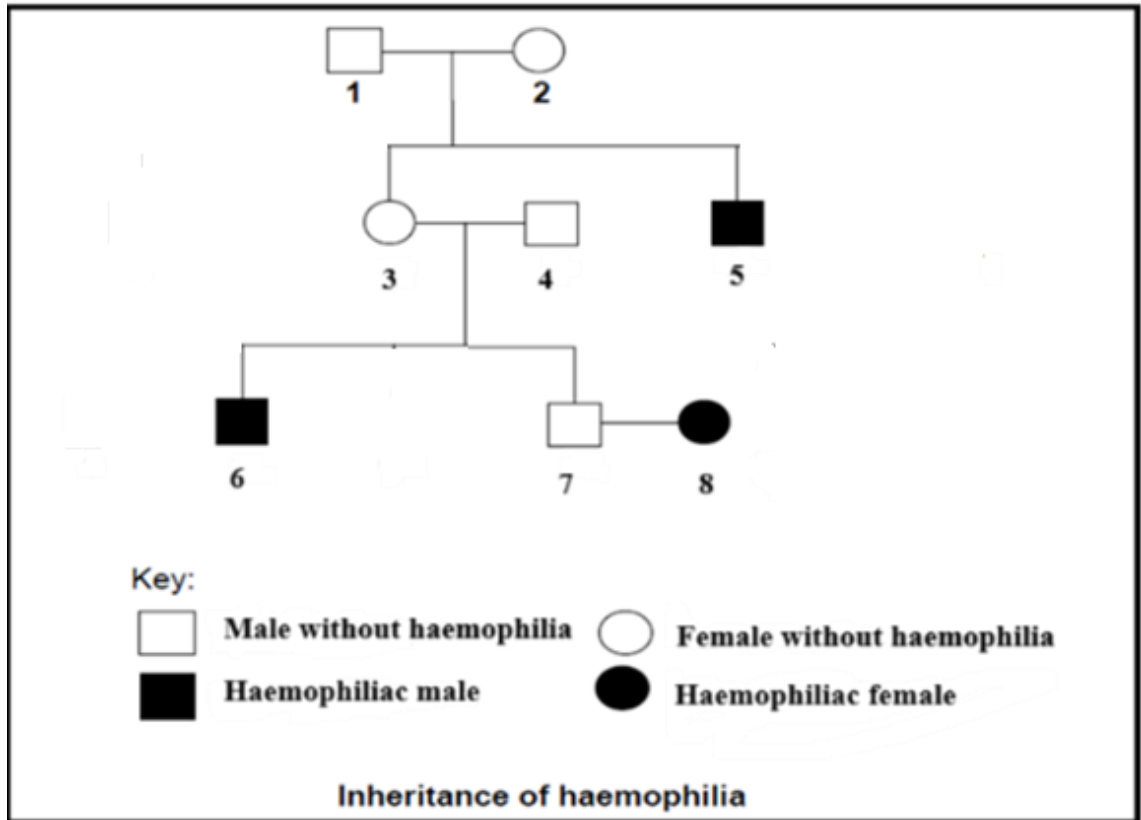
Base triplet number	1	2	3	4	5	6	7
Human DNA sequence	ATG	TGT	CCA	TTA	ACG	TGC	ACA

CODON TABLE	
Cysteine	UGU, UGC
Threonine	ACG, ACA
Tyrosine	UAC, UAU

- 2.1.1 State ONE way in which the DNA molecule is biologically important. (1)
- 2.1.2 Name the codon that is formed from base triplet **number 2** on the DNA sequence. (1)
- 2.1.3 Write down the names of the amino acids coded for by base triplets **6** and **7**. (2)
- 2.1.4 If a mutation changes base triplet **1** from ATG to ATA, why will this not change the protein formed? (2)
- 2.2 Describe the process of translation in protein synthesis. (5)
- 2.3 Tabulate the difference in the sugar component of RNA and DNA. (3)
- (14)**

- 2.4 Brachydactyly is a genetic condition characterized by unusually short fingers. The allele for short fingers is represented by **B**, it is dominant over the allele for normal fingers (**b**). The allele for curly hair (**H**) is dominant over the allele for straight hair (**h**).
- Fanie, with genotype **BBhh**, married Rose, with genotype **bbHh**.
- 2.4.1 State how the phenotypes of Fanie and Rose differ from each other. (2)
- 2.4.2 Give ALL the possible genotypes of the gametes produced by Rose. (2)
- 2.4.3 Explain how Mendel's Law of Independent Assortment applies to parents with BbHh genotypes during gamete formation. (4)
- (8)
- 2.5 Mr. and Mrs. Mashilo are concerned that their baby girl does not appear to resemble either of them. They suspect that the baby they were given at the hospital was not theirs. Mr. Mashilo is blood type **AB**, Mrs. Mashilo is blood type **B** and the baby they were given is blood type **O**.
- 2.5.1 Give the possible genotypes of:
- (a) Mrs. Mashilo (2)
- (b) The baby girl (2)
- 2.5.2 Which 2 alleles are co-dominant in the inheritance of blood groups? (2)
- 2.5.3 Explain why the baby girl with blood type O cannot be Mr. and Mrs. Mashilo's daughter. (3)
- 2.5.4 Explain why the use of blood type for paternity testing is not conclusive. (2)
- 2.6 Using your knowledge of sex chromosomes, explain why the sex of a child is determined by the male gamete. (5)
- (16)

- 2.7 The pedigree diagram below shows the inheritance of *haemophilia* in a family. The allele causing *haemophilia* is represented by X^h and the allele without is represented by X^H .



- 2.7.1 State the:
- Phenotype of individual 3. (1)
 - Genotype of individual 2. (1)
- 2.7.2 Explain why females have a smaller chance of suffering from *Haemophilia*. (3)
- 2.7.3 Use a genetic cross to show the percentage chance of individuals 7 and 8 having a *haemophiliac* son. (7)

(12)**TOTAL SECTION B: [50]**

QUESTION 3

3.1 Pathogens develop resistant to drugs and pesticides because some of the pathogens are naturally resistant to the drugs. When the drugs kill the non-resistant pathogens, only the resistant pathogens remain, resulting in a population of pathogens that cannot be killed by conventional drugs or pesticides.

3.1.1 What does it mean when we say that some pathogens are "naturally resistant" to drugs or pesticides? (1)

3.1.2 In simple terms, explain how using drugs or pesticides can lead to a group of pathogens that are all resistant to treatment according to Charles Darwin (3)

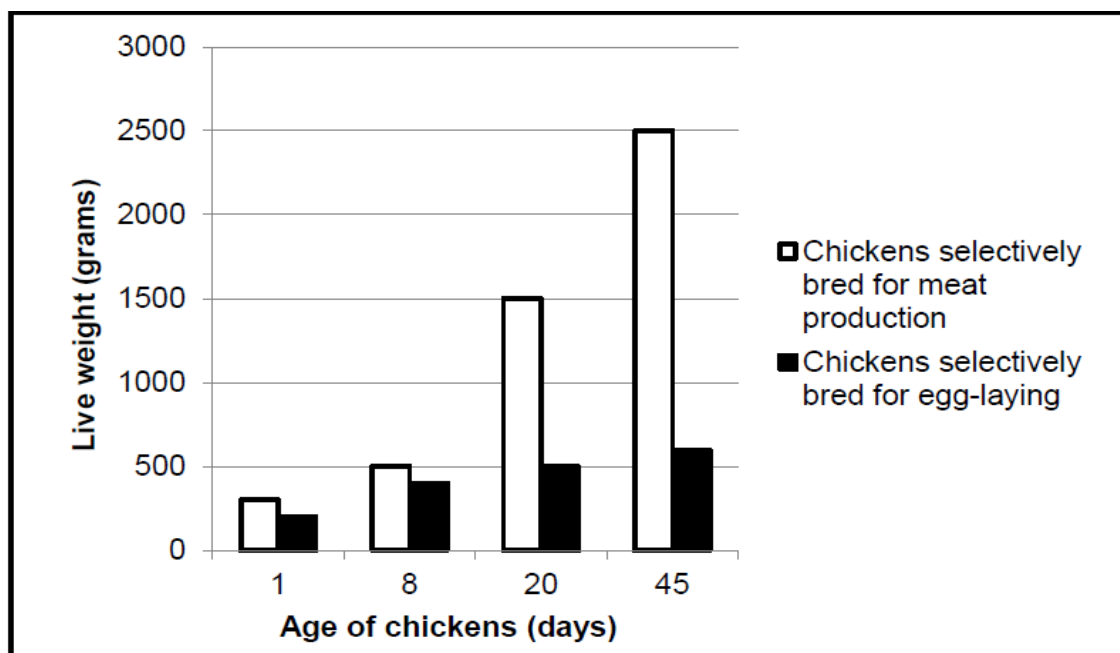
(4)

- 3.2 An investigation was done by Grade 12 learners to determine which chickens grow faster: chickens that are selectively bred for laying eggs or chickens that are selectively bred for meat production.
The following steps were carried out:

1. The learners bought thirty "one -day-old" chickens from a commercial supplier. Fifteen(15) of the chickens had been selectively bred for laying eggs and fifteen(15) of the chickens had been selectively bred for meat production.
2. All the chickens were kept under the same environmental conditions. This included being fed the same chicken feed, made mostly from cereal grains and protein sources.
3. The chickens were weighed regularly for a period of 45 days.

The results of the investigation are shown in the graph below.

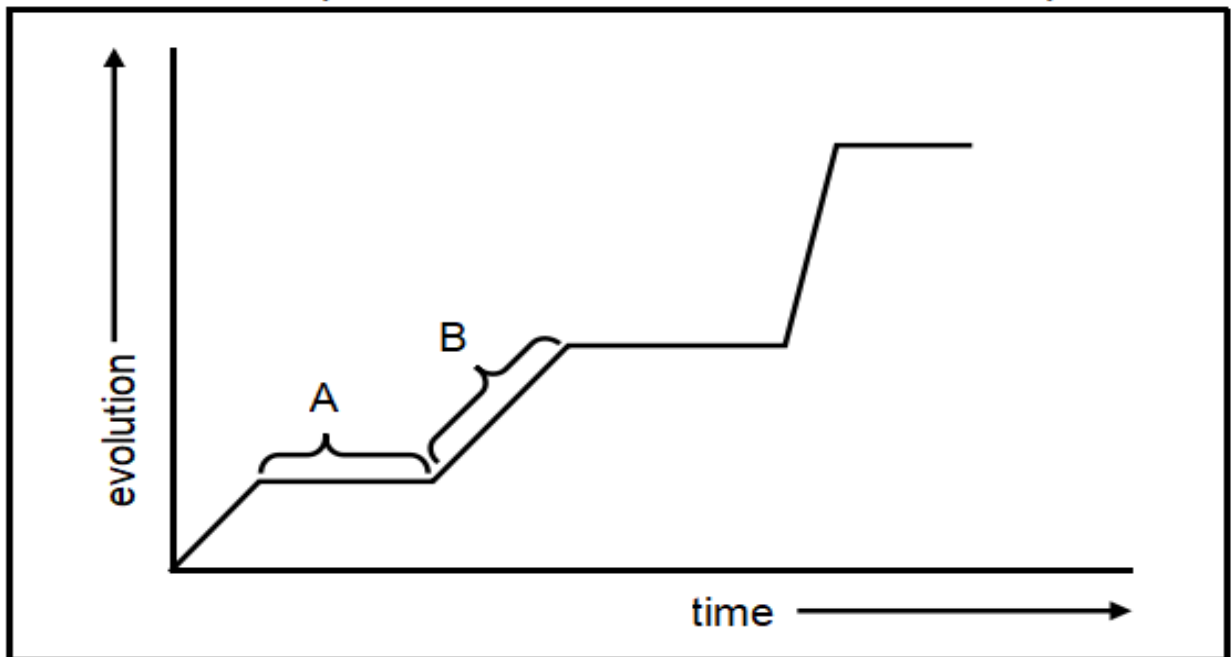
Growth Comparison of Chickens Egg-Laying vs Meat Production Breeds Over Time



[Adapted from www.chicken.org.au]

- 3.2.1 What is a possible conclusion you might derive from this investigation? (2)
- 3.2.2 Identify the: (1)
 (a) Independent variable (1)
 (b) Dependent variable (1)
- 3.2.3 State one factor that should be kept constant. (1)
- 3.2.4 Calculate the percentage weight increase of the chickens that were selectively bred for meat between **day 8 and day 45**. Show ALL working. (2)
- 3.2.5 State one advantage of repeating the investigation with 100 chickens. (2)
- (9)**

3.3 The graph below shows the speed at which evolution occurs in a species of butterfly.



3.3.1 Explain the trend in evolution represented by:

(a) Phase A

(2)

(b) Phase B

(2)

3.3.2 In view of the trend represented by A and B, what type of evolution is represented by the graph?

(1)

3.3.3 Explain why the chances of speciation are great during phase B

(2)

(7)

3.4 Read the passage below

NEW HOMINI SPECIES DISCOVERED

On 13 September 2013 scientists discovered fossils in the Sterkfontein Caves in South Africa which appeared to belong to a previously unknown species of hominins.

The fossils were classified as a new species, *Homo naledi*. The physical characteristics of *H.naledi* are described as having traits similar to the genus *Australopithecus*, mixed with traits more characteristic of the genus *Homo*. It appeared that *H.naledi* represented a transitional fossil

An analysis of *H. naledi*'s skeleton suggests that it stood upright and was bipedal. The structure of the pelvis is similar to the genus *Homo*.

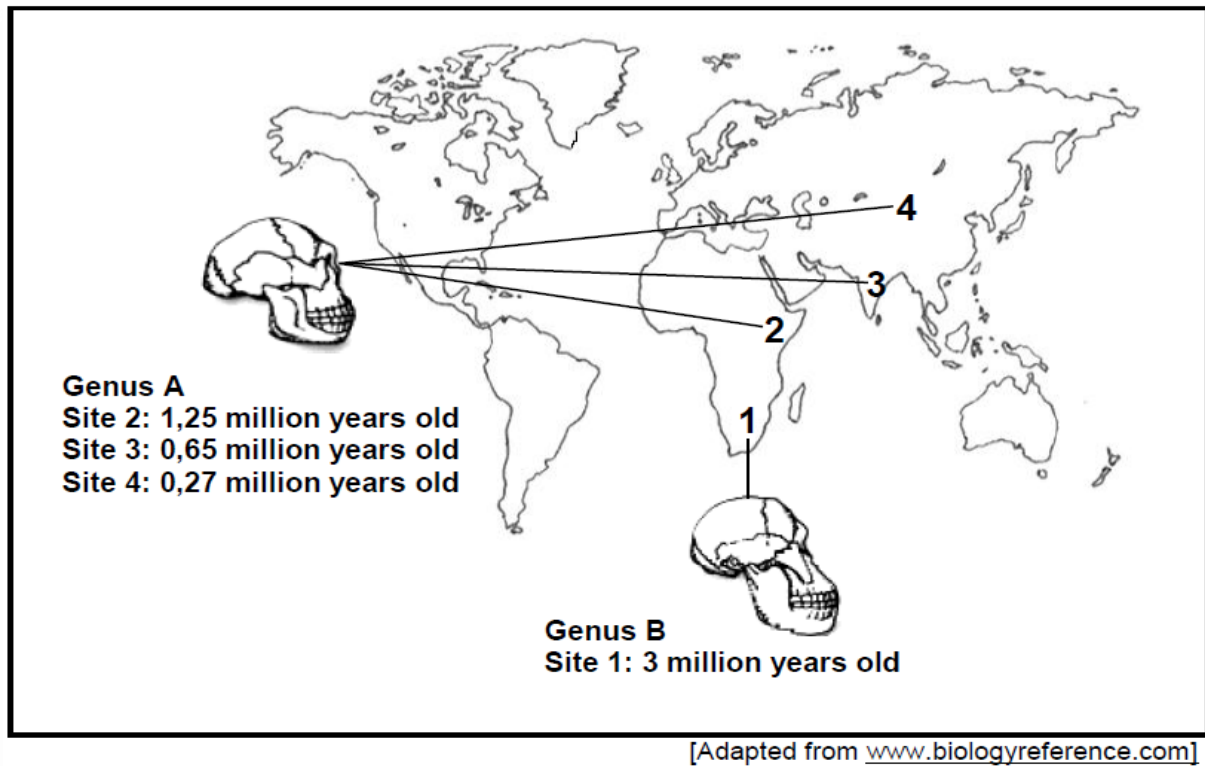
The teeth are much smaller than those of the *Australopithecus* and similar to the teeth of modern humans

[Adapted from <https://humanorigins.si.edu/evidence>]

- 3.4.1 Define the term "transitional fossil". (2)
- 3.4.2 Explain THREE characteristics of a skeleton which are adaptations for bipedalism. (6)
- 3.4.3 Give possible reasons why there was a change to smaller teeth in modern humans. (3)

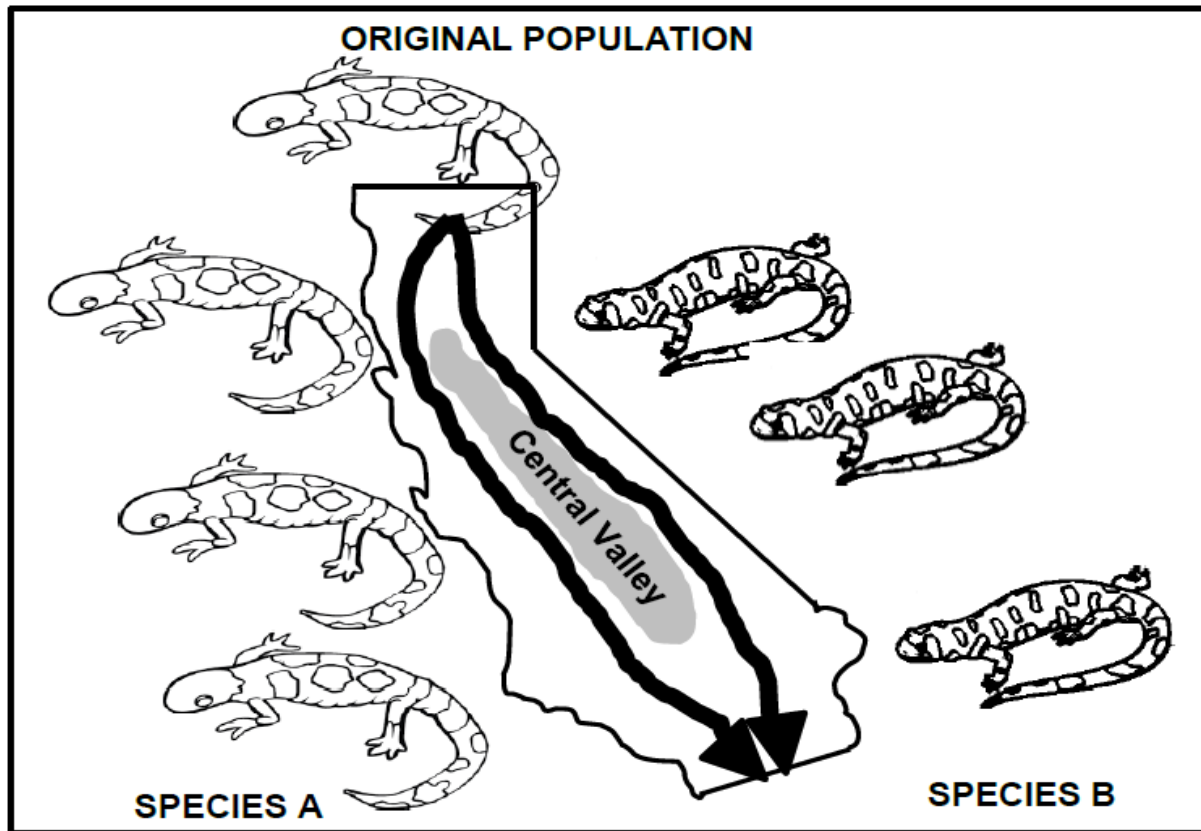
(11)

- 3.5 The diagram below shows a world map indicating four sites (1 to 4) where hominid fossils, representing two different genera, have been found. Genus A was found at three sites and genus B at one site. The age of each fossil was determined using radiometric dating.



- 3.5.1 Which genus (A or B): Represents *Australopithecus*. (1)
- 3.5.2 Name TWO examples of fossils of genus B found at site 1 in South Africa. (2)
- 3.5.3 At which site, 1 to 4, were the youngest fossils found? (1)
- 3.5.4 Other than fossil evidence, what other evidence can be used to support the "Out of Africa hypothesis"? (2)
- (6)

- 3.6 The diagram below shows an evolutionary process taking place in a population of salamanders in California. The process took place gradually, millions of years ago. Study the diagram and answer the questions that follow.



- 3.6.1 Define what biological species is? (3)
- 3.6.2 Name and describe the process in the diagram above? (6)
- 3.6.3 Discuss how natural selection could lead to the development of different traits in two isolated populations of the same species living in different environments. (4)
- (13)
- (50)
- TOTAL SECTION B: 100**
- GRAND TOTAL: 150**

AMENDED FINAL



KWAZULU-NATAL PROVINCE

**EDUCATION
REPUBLIC OF SOUTH AFRICA**

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

LIFE SCIENCES P2

PREPARATORY EXAMINATION

SEPTEMBER 2025

MARKS: 150

TIME: 2½ hour

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 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.

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 to D) next to the question number (1.1.1 to 1.1.9) in the ANSWER BOOK, for example 1.1.10 D.

1.1.1 Sources of variation in a human population are ...

- A mutations, mitosis, random mating and random fertilisation.
- B replication, random mating, meiosis and mitosis.
- C mutations, meiosis, random fertilisation and random mating.
- D random mating, replication, random fertilisation and meiosis.

1.1.2 Meiosis is a significant type of cell division, as it is responsible for the ...

- A production of genetically identical gametes.
- B doubling of the chromosome number from generation to generation.
- C production of haploid gametes.
- D production of diploid gametes.

1.1.3 A portion of a DNA molecule has 140 guanine and 70 thymine nitrogenous bases.

What is the total number of deoxyribose sugars in this portion of the DNA molecule?

- A 420
- B 210
- C 140
- D 70

1.1.4 A homozygous purple flowering plant (**P**) is crossed with a pink flowering plant (**p**) to produce the F1-generation. One of the offspring from the F1 generation is crossed with a pink flowering plant to produce the F2-generation offspring.

Which ONE of the following is the CORRECT phenotypic ratio of the F2-generation?

- A 1 purple flowering plant: 1 pink flowering plant
- B 1 purple flowering plant: 3 pink flowering plant
- C 3 purple flowering plant: 1 pink flowering plant
- D 1 purple flowering plant: 2 pink flowering plant

1.1.5 Which ONE of the following genotypes is possible in the offspring of a homozygous male with blood group **A** and a female with blood group **B**?

- A $I^A I^A$
- B $I^A i$
- C ii
- D $I^B i$

1.1.6 The reproductive isolation mechanism characterised by an animal displaying a specific action to attract a mating partner is known as ...

- A breeding at different times of the year.
- B species-specific courtship behavior.
- C infertile offspring.
- D prevention of fertilization.

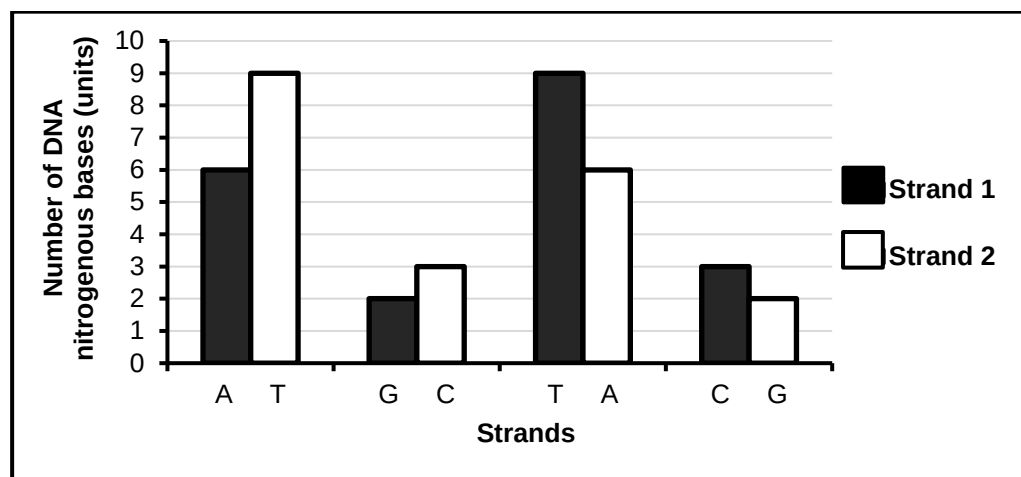
1.1.7 Below is a list of statements in human evolution.

- (i) *Australopithecus* fossils were found in Africa only
- (ii) *Homo habilis* fossils were found in Africa only
- (iii) *Homo sapiens* fossils were found in Africa only
- (iv) The oldest *Homo erectus* fossil was found in Africa

Which ONE of the following combinations is the CORRECT fossil evidence for the "Out of Africa hypothesis"?

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

- 1.1.8 The graph below shows a portion of a DNA molecule containing 20 nitrogenous bases in each strand.



Strand 2 was used as a template for the formation of mRNA during protein synthesis.

The percentage difference between **uracil** and **adenine** on the mRNA strand is ...

- A 30
- B 20
- C 15
- D 0

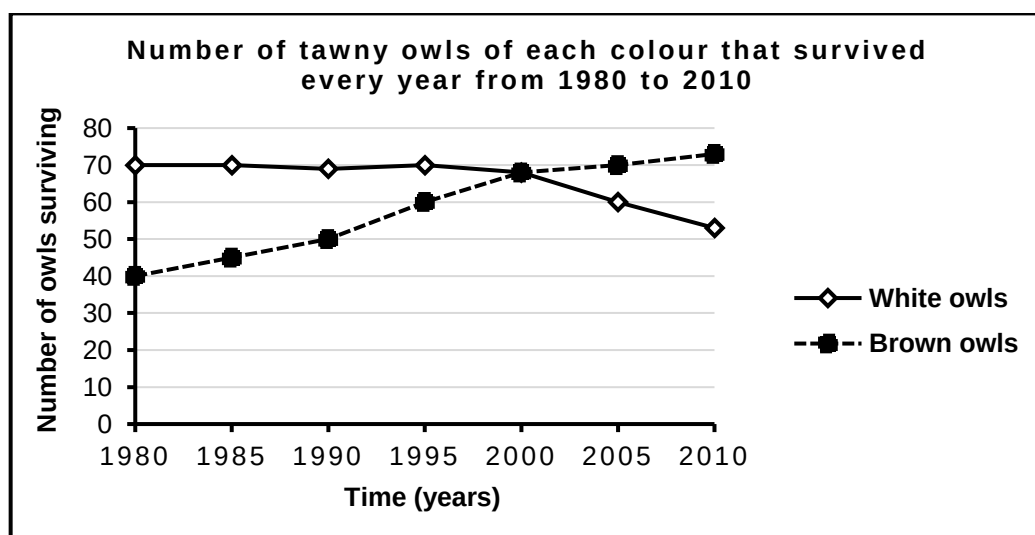
- 1.1.9 There is variation in the colour of tawny owls. Some are white and others are brown in colour.

Scientists studied these owls over a period of 30 years, from 1980 to 2010, to determine the effect of climate change that caused increasing global temperatures with less snow each year.

The scientists:

- Conducted the investigation over the same four months of winter each year.
- Observed the same population of tawny owls each year.
- Determined the number of tawny owls of each colour that survived every year.

The results are shown in the graph below:



What conclusion can be made about the suitability of each colour owl to survive in **more** snow?

- A The brown owls are less suited to survive than the white owls
B The white owls are less suited to survive than the brown owls
C Both brown and white owls are equally suited to survive
D The brown owls are more suited to survive than the white owls

(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 number (1.2.1 to 1.2.9) in the ANSWER BOOK.

- 1.2.1 The number, shape and arrangement of all the chromosomes in the nucleus of a somatic cell
- 1.2.2 The opening in the base of the skull through which the spinal cord passes
- 1.2.3 The study of the distribution of living organisms found in different regions
- 1.2.4 The permanent disappearance of a species from earth
- 1.2.5 An inherited disorder where blood fails to clot properly
- 1.2.6 The act or ability of using two feet for walking or locomotion
- 1.2.7 An organelle that is responsible for protein synthesis
- 1.2.8 The type of evolution characterised by long periods of little or no change followed by short periods of rapid change
- 1.2.9 A phase in the cell cycle where DNA replication occurs

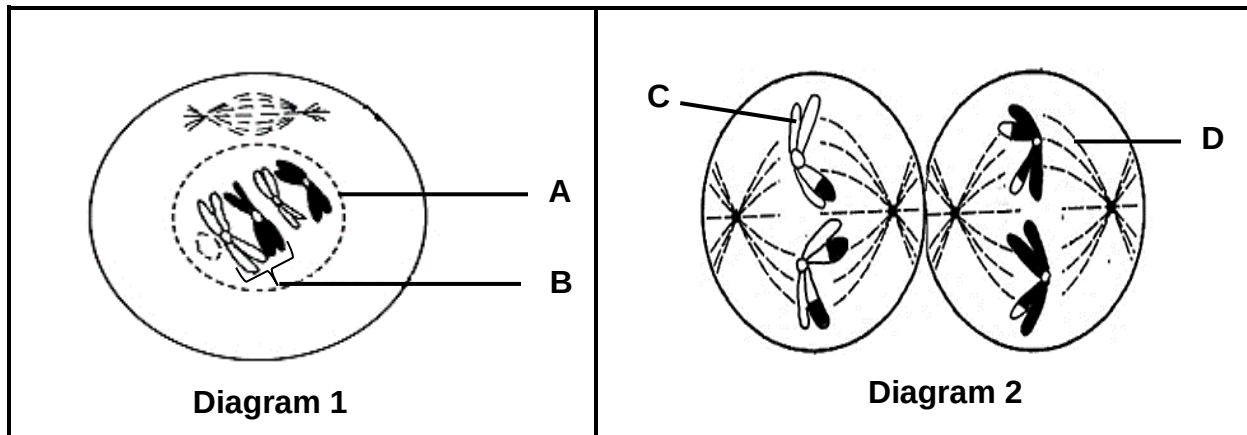
(9 × 1) **(9)**

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 point where two chromatids overlap	A: Chiasma B: Locus
1.3.2	There is a range of different phenotypes for a particular characteristic	A: Continuous variation B: Discontinuous variation
1.3.3	Fossils found in South Africa	A: Little Foot B: Taung Child

(3 × 2) **(6)**

1.4 The diagrams below represent a cell in two different phases of meiosis in no order.



1.4.1 Identify the phase of meiosis represented in diagram:

(a) 1 (1)

(b) 2 (1)

1.4.2 Give the LETTER and NAME of the part that:

(a) Disappears at the end of the phase in **diagram 1** (2)

(b) Pulls chromatids towards opposite poles (2)

1.4.3 Give the number of chromatids number in each cell in **diagram 2**. (1)

1.4.4 Name the:

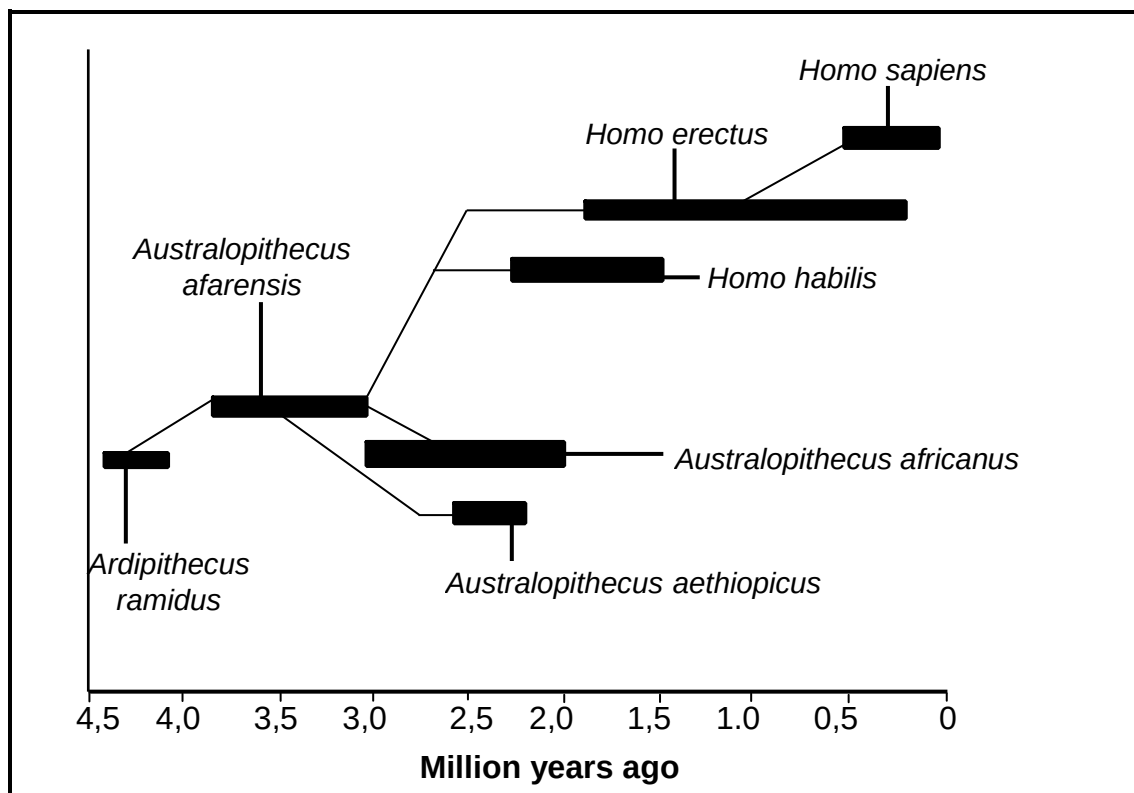
(a) Process that caused the appearance of chromosomes in **diagram 2**. (1)

(b) Phase that follows the one shown in **diagram 1**. (1)

(c) Organ in the female body where the process of meiosis occurs. (1)

(10)

1.5 The diagram below illustrates evolutionary relationships and shared ancestry.



1.5.1 Identify:

(a) The diagram shown above (1)

(b) TWO genera that existed between 2.5 and 1.5 million years ago (2)

1.5.2 When did *Homo habilis* become extinct? (1)

1.5.3 State how many million years *Australopithecus africanus* lived for? (1)

1.5.4 Name the:

(a) Most recent ancestor of *Homo habilis* (1)

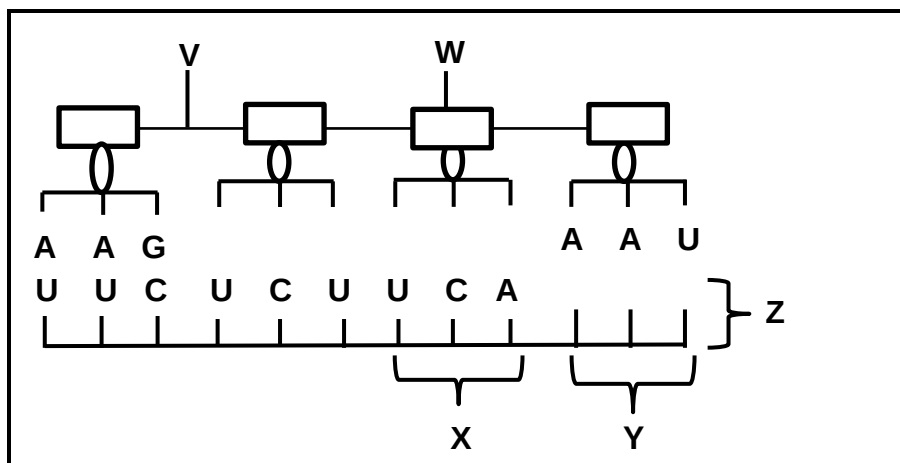
(b) Family to which all the species in the diagram above belong (1)

(7)

TOTAL SECTION A: 50

SECTION B**QUESTION 2**

2.1 The diagram below shows part of the process involved in protein synthesis.



2.1.1 Name the stage of protein synthesis that is shown in the diagram. (1)

2.1.2 Identify:

(a) Structure **V** (1)

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

2.1.3 Give the:

(a) Collective name of the nitrogenous bases **X** (1)

(b) DNA base triplet that code for **Y** (1)

2.1.4 The table below shows amino acids and the DNA base triplets that code for them.

AMINO ACID	DNA BASE TRIPLET
Leucine	AGT
Glycine	AAG
Glutamic Acid	AAT
Proline	AGA

With reference to the diagram and the table above:

(a) Write down the codon that codes for proline (1)

(b) Name the last TWO amino acids coded for by molecule **Z** in the diagram (from left to right) (2)

(8)

2.2

Describe the process of *transcription*.

(6)

2.3

Read the passage below.

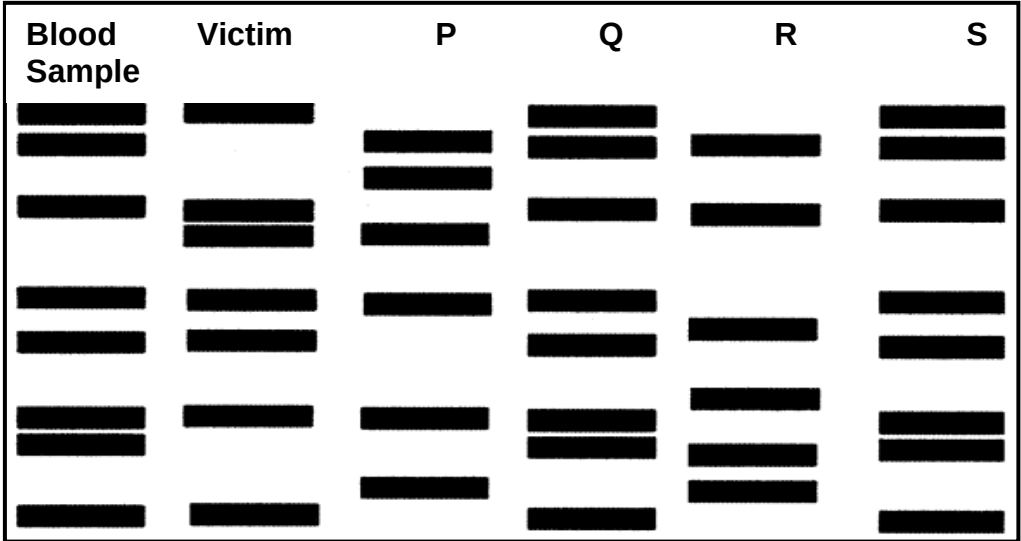
The Komodo dragon and Timor monitor are two different types of monitor lizards. They evolved from a population of the common ancestor and adapted on different islands over time. These different species of monitor lizards show differences in body size and diet.

Komodo dragons have a larger body size than Timor monitors. The Komodo dragon feeds on larger prey such as deer and pigs, whereas the Timor monitor feeds on small prey such as insects.

- 2.3.1
- Define the term *population*.
- (2)
- 2.3.2
- From the passage, name the species that feeds on insects.
- (1)
- 2.3.3
- Describe how the Komodo dragon and Timor monitor could have evolved from a common ancestor.
- (6)
- (9)

2.4

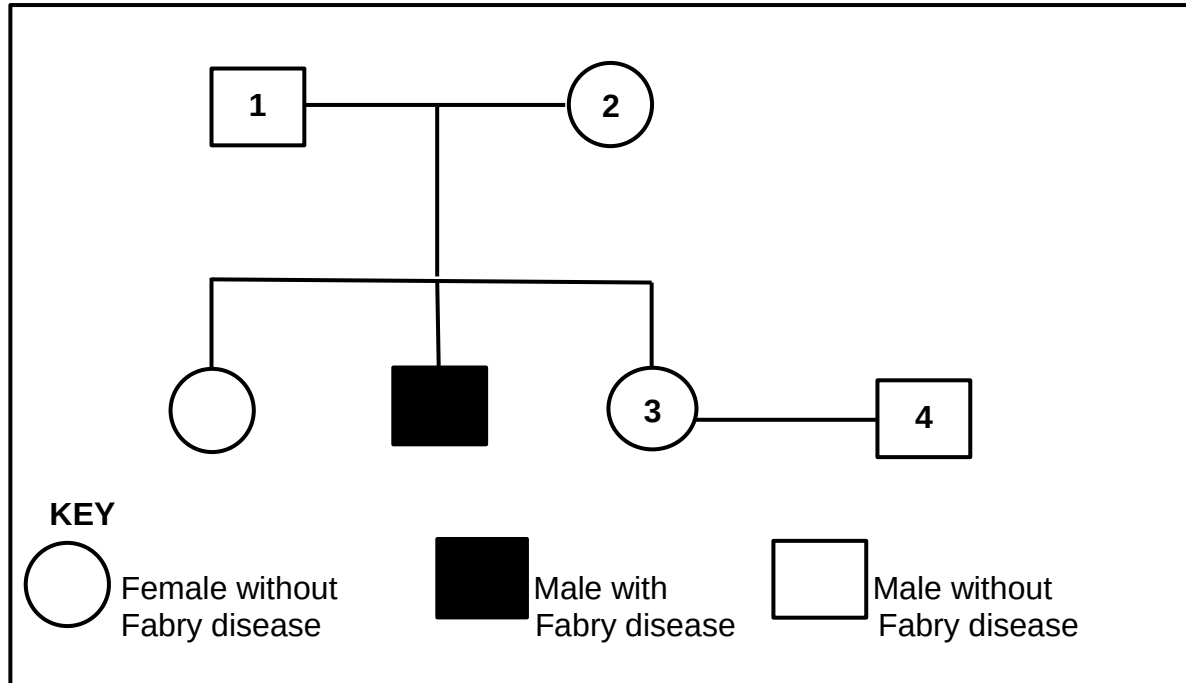
The diagram below shows the DNA profiles of a blood sample found at a crime scene, a victim and suspects **P**, **Q**, **R** and **S**.



- 2.4.1
- State the conclusion that can be drawn from the analysis of the DNA profiles of **Q** and **S**.
- (2)
- 2.4.2
- Give TWO reasons why DNA profiling does not always provide conclusive evidence in criminal investigations.
- (2)
- 2.4.3
- State TWO benefits of using DNA profiling other than that of solving crimes.
- (2)
- 2.4.4
- Explain why DNA profiling is a reliable method of identifying suspects in criminal investigations.
- (2)
- (8)

- 2.5 Fabry disease is a sex-linked disorder that affects the kidney, heart, brain and skin. A recessive allele X^b causes Fabry disease in humans.

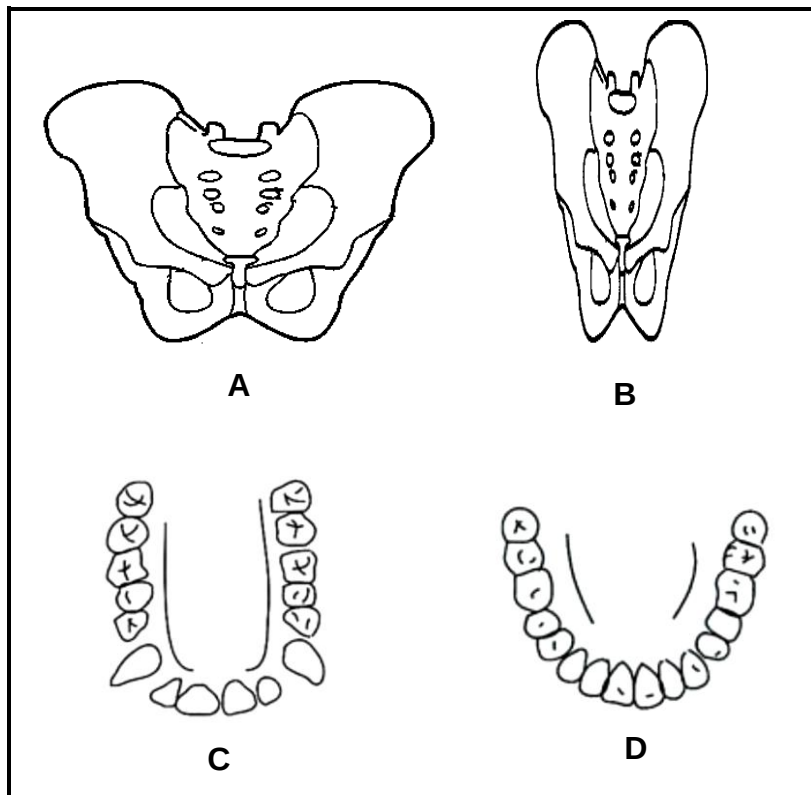
The pedigree diagram below shows the inheritance of Fabry disease in a family.



- 2.5.1 How many generations are represented in the pedigree diagram above? (1)
- 2.5.2 Give the genotype of individual 2. (1)
- 2.5.3 Explain why males are most likely to be affected by Fabry disease. (3)
- 2.5.4 Individual 3 is heterozygous and is planning to have a child with her husband (individual 4).

Use a genetic cross to show ALL the possible phenotypes of their offspring. (6)
(11)

2.6 The diagrams below show structures belonging to *Homo sapiens* and the Chimpanzee.



2.6.1 Write down the LETTER of the diagram that represents the pelvic structure of a quadrupedal organism. (1)

2.6.2 Tabulate TWO visible differences between jaw C and D. (5)

2.6.3 Explain the significance of the change in pelvis from B to A. (2)

(8)

[50]

QUESTION 3

3.1 Read the passage below.

Stem cell transplants are used to treat cancers that affect the blood and immune system such as lymphoma and leukaemia. It replaces the cells damaged by chemotherapy. The treatment uses stem cells from embryos and bone marrow of adult tissues to restore healthy blood cell production.

3.1.1 From the passage, give:

- (a) TWO sources where stem cells can be collected (2)
- (b) TWO types of cancer that can be treated using stem cells (2)

3.1.2 Stem cells from bone marrow of an adult can be used to replace cells that are damaged by chemotherapy.

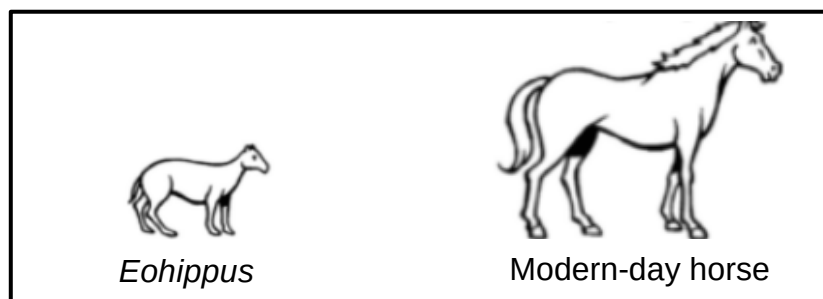
Explain why stem cells are used in replacing these damaged cells. (2)
(6)

3.2 Read the passage below.

During the Industrial Revolution in England, pollution from factories blackened trees with soot. This led to a shift in the peppered moth population from primarily light-coloured to dark-coloured moths because the dark moths were better camouflaged against the darkened bark and were thus less likely to be preyed upon by birds.

Using Darwin's theory of natural selection, explain why the population of dark- coloured moths increased after the Industrial Revolution in England. (7)

3.3 The earliest horse ancestors, *Eohippus* were small animals that lived in forests, roughly the size of a dog, with short legs. Due to climate change, forests were reduced, and grasslands expanded. Animals had to outrun predators on the open grasslands to survive.



Use Lamarck's theory to explain the evolution of modern-day horses with long legs. (6)

- 3.4 A farmer collected 20 fish of two different colours (yellow fish and blue fish) with similar characteristics.

An investigation was carried out to determine the dominant colour in this species of fish.

The procedure was as follows:

- Healthy yellow fish and blue fish were selected
- 10 fish were yellow in colour and the other 10 fish were blue
- 2 male fish of each colour were included
- All fish were of the same reproductive age
- The fish were bred for five years
- 100 offspring were collected each year to observe the dominant colours

The table below shows the average results of the offspring.

PHENOTYPE	AVERAGE NUMBER OF FISH OVER FIVE YEARS
Yellow	19
Green	65
Blue	16

- 3.4.1 Give TWO planning steps that would have been taken for this investigation. (2)
- 3.4.2 State TWO ways in which the:
- (a) Farmer improved the reliability of this investigation (2)
- (b) Validity of the investigation was ensured (2)
- 3.4.3 Name the type of dominance shown in this investigation. (1)
- 3.4.4 Give a reason for your answer in QUESTION 3.4.3. (2)
- 3.4.5 Based on the results shown in the table, explain why the green phenotype is more common than the yellow and blue phenotype in the offspring. (2)
- 3.4.6 Draw a bar graph to show the average number of fish over five years for each phenotype given in the table above. (6)
- (17)**

- 3.5 Describe how non- disjunction leads to Down syndrome. (5)
- 3.6 In grape plants, red fruit colour (**R**) is dominant over green fruit colour (**r**), and broad leaf (**B**) is dominant over narrow leaf (**b**).

A grape plant that is heterozygous for both red fruit and broad leaf is crossed with a plant that is heterozygous for red fruit and narrow leaf.

The following table shows the results of the genetic cross between the two plants.

PHENOTYPE	NUMBER OF OFFSPRING
Red fruit and broad leaf	288
Green fruit and narrow leaf	108
Green fruit and broad leaf	96
Red fruit and narrow leaf	296

- 3.6.1 Identify the type of cross referred to above. (1)

- 3.6.2 Give a reason for your answer in QUESTION 3.6.1. (1)

- 3.6.3 Give the:

- (a) Genotypes of the parent plants that were crossed (2)

- (b) Possible genotypes in the gametes of the heterozygous red fruit and narrow leaf (2)

- (c) Phenotypic ratio of red fruit and broad leaf to green fruit and broad leaf (2)

- 3.6.4 A grape plant homozygous for the dominant characteristics is crossed with a grape plant homozygous for the recessive characteristics.

How many grape plants in the next generation are likely to have green fruit and narrow leaf? (1)

(9)

[50]

TOTAL SECTION B: 100

GRAND TOTAL: 150

FINAL



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

LIFE SCIENCES P2
PREPARATORY EXAMINATION
MARKING GUIDELINE
SEPTEMBER 2025

MARKS: 150

TIME: 2½ hour

This marking guideline consists of 10 pages.

PRINCIPLES RELATED TO MARKING LIFE SCIENCES SEPTEMBER 2025

1. **If more information than marks allocated is given**
Stop marking when maximum marks are reached and put a wavy line and 'max' in the right-hand margin.
2. **If, for example, three reasons are required and five are given**
Mark the first three irrespective of whether all or some are correct/incorrect.
3. **If whole process is given when only part of it is required**
Read all and credit relevant part.
4. **If comparisons are asked for and descriptions are given**
Accept if differences / similarities are clear.
5. **If tabulation is required but paragraphs are given**
Candidates will lose marks for not tabulating.
6. **If diagrams are given with annotations when descriptions are required**
Candidates will lose marks
7. **If flow charts are given instead of descriptions**
Candidates will lose marks.
8. **If sequence is muddled and links do not make sense**
Where sequence and links are correct, credit. Where sequence and links is incorrect, do not credit. If sequence and links becomes correct again, resume credit.
9. **Non-recognised abbreviations**
Accept if first defined in answer. If not defined, do not credit the unrecognized abbreviation but credit the rest of answer if correct.
10. **Wrong numbering**
If answer fits into the correct sequence of questions but the wrong number is given, it is acceptable.
11. **If language used changes the intended meaning**
Do not accept.
12. **Spelling errors**
If recognizable accept provided it does not mean something else in Life Sciences or if it is out of context.

13. **If common names given in terminology**
Accept provided it was accepted at the National memo discussion meeting.
14. **If only letter is asked for and only name is given (and vice versa)**
No credit
15. **If units are not given in measurements**
Candidates will lose marks. Memorandum will allocate marks for units separately
16. Be sensitive to the **sense of an answer, which may be stated in a different way.**
17. **Caption**
All illustrations (diagrams, graphs, tables, etc.) must have a caption
18. **Code-switching of official languages (terms and concepts)**
A single word or two that appears in any official language other than the learners' assessment language used to the greatest extent in his/her answers should be credited, if it is correct. A marker that is proficient in the relevant official language should be consulted. This is applicable to all official languages.

SECTION A**QUESTION 1**

1.1	1.1.1	C✓✓		
	1.1.2	C✓✓		
	1.1.3	A✓✓		
	1.1.4	A✓✓		
	1.1.5	B✓✓		
	1.1.6	B✓✓		
	1.1.7	C✓✓		
	1.1.8	C✓✓		
	1.1.9	A✓✓		
			(9 x 2)	(18)
1.2	1.2.1	Karyotype✓		
	1.2.2	Foramen magnum✓		
	1.2.3	Biogeography✓		
	1.2.4	Extinction✓		
	1.2.5	Haemophilia ✓		
	1.2.6	Bipedalism✓		
	1.2.7	Ribosome✓		
	1.2.8	Punctuated equilibrium✓		
	1.2.9	Interphase✓		
			(9 x 1)	(9)
1.3	1.3.1	A only✓✓		
	1.3.2	A only✓✓		
	1.3.3	Both A and B✓✓		
			(3 x 2)	(6)
1.4	1.4.1	(a) Prophase 1✓		(1)
		(b) Metaphase 2✓		(1)
	1.4.2	(a) A✓ Nuclear membrane✓		(2)
		(b) D ✓ Spindle fibre✓		(2)
	1.4.3	4✓/ four		(1)
	1.4.4	(a) Crossing over ✓		(1)
		(b) Metaphase 1✓		(1)
		(c) Ovary✓		(1)
				(10)
1.5	1.5.1	(a) Phylogenetic Tree✓		(1)
		(b) - <i>Australopithecus</i> ✓		
		- <i>Homo</i> ✓		(2)
		(Mark first TWO only)		
	1.5.2	1.4 mya✓ (accept range 1.4 – 1.5)		(1)
	1.5.3	1✓ million years (accept range 1 – 1.2)		(1)

- 1.5.4 (a) *Australopithecus afarensis*✓ (1)
 (b) Hominidae✓ (1)
 (7)

TOTAL SECTION A: 50

SECTION B

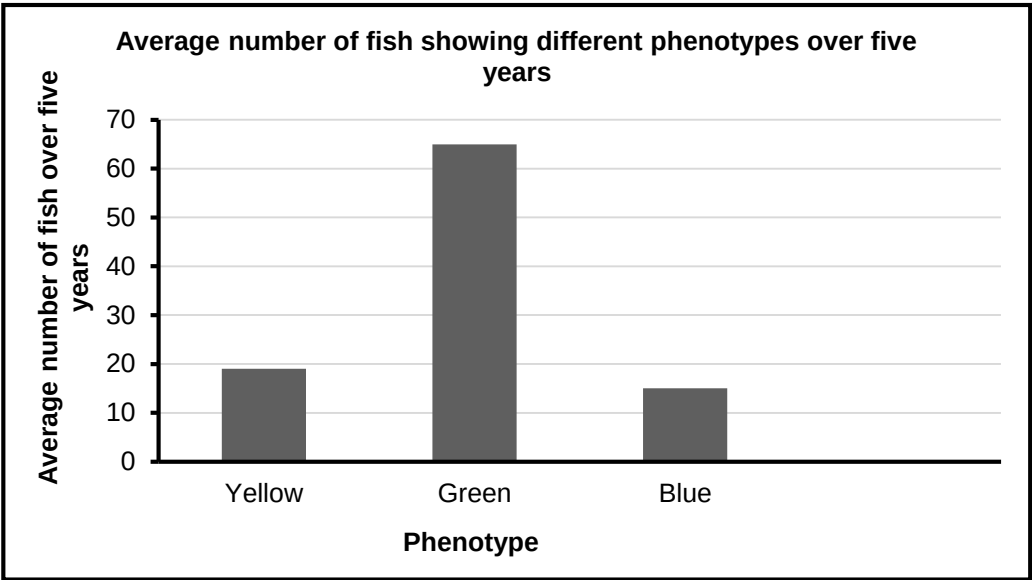
QUESTION 2

- 2.1 2.1.1 Translation✓ (1)
 2.1.2 (a) Peptide bond✓ (1)
 (b) Amino acid✓ (1)
 2.1.3 (a) codon✓ (1)
 (b) AAT✓ (1)
 2.1.4 (a) UCU✓ (1)
 (b) - Leucine✓
 - Glutamic acid✓ (2)
(Mark first TWO only) (8)
- 2.2 - The double helix DNA unwinds✓
 - The double-stranded DNA unzips✓/weak hydrogen bonds break to form two separate strands.
 - One strand is used as a template✓
 - to form mRNA✓
 - using free RNA nucleotides from the nucleoplasm✓
 - The mRNA is complementary to DNA✓
 - mRNA now has the coded message for protein synthesis✓ Any (6)
- 2.3 2.3.1 - A group of organisms of the same species✓
 - occupying the same habitat✓
 - at the same time✓ Any (2)
- 2.3.2 Timor monitors✓ (1)
- 2.3.3 - The original population of lizards/ common ancestor became separated by the geographical barrier✓ / oceans/ sea / river
 - Then the population splits into two✓
 - There was no gene flow between the two populations✓
 - Each population experienced different environmental conditions✓/ the selective pressure may be different
 - and therefore natural selection occur independently✓
 - such that the individuals of the two populations became different✓
 - genotypically and phenotypically✓
 - Even if these two populations were to mix again✓
 - they will not be able to interbreed✓
 - forming the different species, Komodo dragon and Timor monitor ✓*
***Compulsory + 5** Any (6)
 (9)

- 2.4 2.4.1 Both Q and S were at the crime scene✓✓
OR
They are identical twins✓✓ (2)
- 2.4.2 - Human error may occur✓
- Only a small amount of DNA was used✓ and may not be reliable
- Framing✓/planting false evidence
- Suspect can have an identical twin✓ with the same DNA profile Any (2)
(Mark first TWO only)
- 2.4.3 - Paternity testing✓
- Establish compatible tissue types for organ transplant✓
- Identify relatives✓
- Find inherited disorders✓
- Develop cures for inherited disorders✓ Any (2)
(Mark first TWO only)
- 2.4.4 - DNA profile of each individual is unique✓
- except in the case of identical twins✓ (2)
(8)
- 2.5 2.5.1 2✓ / two (1)
- 2.5.2 $X^B X^b$ ✓ (1)
- 2.5.3 - Males only have one X chromosome✓ / XY
- and need only one recessive allele✓ / X^b
- to have Fabry disease✓
- There is no allele to mask the recessive one✓ Any (3)
- 2.5.4 P1 Phenotype: Unaffected female x Unaffected male✓
- Genotype: $X^B X^b$ x $X^B Y$ ✓
- Meiosis Gametes: X^B, X^b x X^B, Y ✓
- Fertilisation
- F.1 Genotype: $X^B X^B, X^B Y, X^B X^b, X^b Y$ ✓
- Phenotype: Unaffected females, unaffected male, affected male✓*
- P1 and F1✓
Meiosis and fertilisation ✓

- 3.2 3.2.1 (a) No answer (6)
- (b) - There was variation✓ amongst the population of the moths
- some were light-coloured and others were dark-coloured✓
 - When exposed to blackened trees✓
 - the moths with light colour were visible to the predators and died✓
 - Those with dark colour were camouflaged, survived✓
 - and reproduced ✓
 - passing the allele for the dark colour to their offspring✓
 - The next generation had a higher proportion of moths with dark colour✓
- Any (7)
(13)
- 3.3 3.3.1 - Decide on time to allow the mating of the two fish✓
- Decide on the sample size✓
 - Decide on recording tool✓
 - Decide on the time✓ / date/ session for sampling
- Any (2)
- (Mark first TWO only)**
- 3.3.2 (a) - 20 fish✓ were collected
- Conducted over 5 years✓
- (2)
- (Mark first TWO only)**
- (b) - Same number of male fish in each species✓
- Only healthy fish were selected✓
 - Same reproductive age✓ fish species
- Any (2)
- (Mark first TWO only)**
- 3.3.3 Incomplete✓ dominance (1)
- 3.3.4 - The offspring show a green colour which is an intermediate phenotype✓
- Neither allele for blue nor yellow colour is dominant over the other✓
- (2)
- 3.3.5 - There was a greater chance of heterozygous green offspring✓
- being produced in each generation✓
- (2)

3.3.6



Guideline for ASSESSING GRAPH

CRITERIA	MARK
Bar graph is drawn (T)	1
Caption of the graph includes both variables (C)	1
Correct labels on the X and Y axes with correct units (L)	1
Correct scale for X and Y-axes (S) equal space and width of bars	1
Plotting of co-ordinates (P) correctly: 1 to 2	1
All 3 co-ordinates plotted correctly	2

(6)
(17)

- 3.4
- Homologous chromosome pair/ chromosomes on position 21 fail to separate✓
 - during Anaphase I✓/ II
 - Gamete will have an extra chromosome✓/ 24 chromosomes
 - When this gamete is fertilised by a normal gamete✓with 23 chromosomes
 - the zygote will have 47 chromosomes✓/extra chromosomes on pair 21/Trisomy 21

(5)

- 3.5
- 3.5.1

Dihybrid✓cross

(1)
- 3.5.2

Two characteristics/ pairs of alleles are crossed✓

(1)
- 3.5.3

(a) - RrBb✓

- Rrbb✓

(2)

(b) - Rb✓

- rb ✓

(2)

(c) 3:1✓✓

(2)

3.5.4 0✓
 OR
 4✓/ all

(1)
(9)

CONVERSION TABLE FOR 1.1	
CANDIDATE MARK	ADJUSTMENT
1 – 3	No mark (0)
4 – 11	+1 mark
12 – 19	+ 2 marks
20 – 25	+ 3 marks
26 – 33	+ 4 marks
34 – 40	+ 5 marks
41 - 44	+ 6 marks

TOTAL SECTION B: 100

GRAND TOTAL: 150



DEPARTMENT OF EDUCATION
DEPARTEMENT VAN ONDERWYS
LEFAPHA LA THUTO
ISEBE LEZEMFUNDO

PROVINCIAL PREPARATORY EXAMINATION

GRADE 12

**LIFE SCIENCES
PAPER 2
SEPTEMBER 2025
MARKING GUIDELINES**

MARKS: 150

These marking guidelines consist of 14 pages.

PRINCIPLES RELATED TO MARKING LIFE SCIENCES

1. **If more information than marks allocated is given**
Stop marking when maximum marks is reached and put a wavy line and 'max' in the right-hand margin.
2. **If, for example, three reasons are required and five are given**
Mark the first three irrespective of whether all or some are correct/incorrect.
3. **If whole process is given when only a part of it is required**
Read all and credit the relevant part.
4. **If comparisons are asked for, but descriptions are given**
Accept if the differences/similarities are clear.
5. **If tabulation is required, but paragraphs are given**
Candidates will lose marks for not tabulating.
6. **If diagrams are given with annotations when descriptions are required**
Candidates will lose marks.
7. **If flow charts are given instead of descriptions**
Candidates will lose marks.
8. **If sequence is muddled and links do not make sense**
Where sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If sequence and links become correct again, resume credit.
9. **Non-recognised abbreviations**
Accept if first defined in answer. If not defined, do not credit the unrecognised abbreviation, but credit the rest of the answer if correct.
10. **Wrong numbering**
If answer fits into the correct sequence of questions, but the wrong number is given, it is acceptable.
11. **If language used changes the intended meaning**
Do not accept.
12. **Spelling errors**
If recognisable, accept the answer, provided it does not mean something else in Life Sciences or if it is out of context.
13. **If common names are given in terminology**
Accept, provided it was accepted at the provincial memo discussion meeting.

14. **If only the letter is asked for, but only the name is given (and vice versa)**
Do not credit.
15. **If units are not given in measurements**
Candidates will lose marks. Memorandum will allocate marks for units separately.
16. **Be sensitive to the sense of an answer, which may be stated in a different way.**
17. **Caption**
All illustrations (diagrams, graphs, tables, etc.) must have a caption.
18. **Code-switching of official languages (terms and concepts)**
A single word or two that appear(s) in any official language other than the learner's assessment language used to the greatest extent in his/her answers should be credited, if it is correct. A marker that is proficient in the relevant official language should be consulted. This is applicable to all official languages.
19. **Changes to the memorandum**
No changes must be made to the memorandum without the approval of the examiner and moderator.
20. **Official memoranda**
Only memoranda bearing the signatures of the provincial internal moderator and distributed by the Provincial Education Department via the districts must be used.

SECTION A**QUESTION 1**

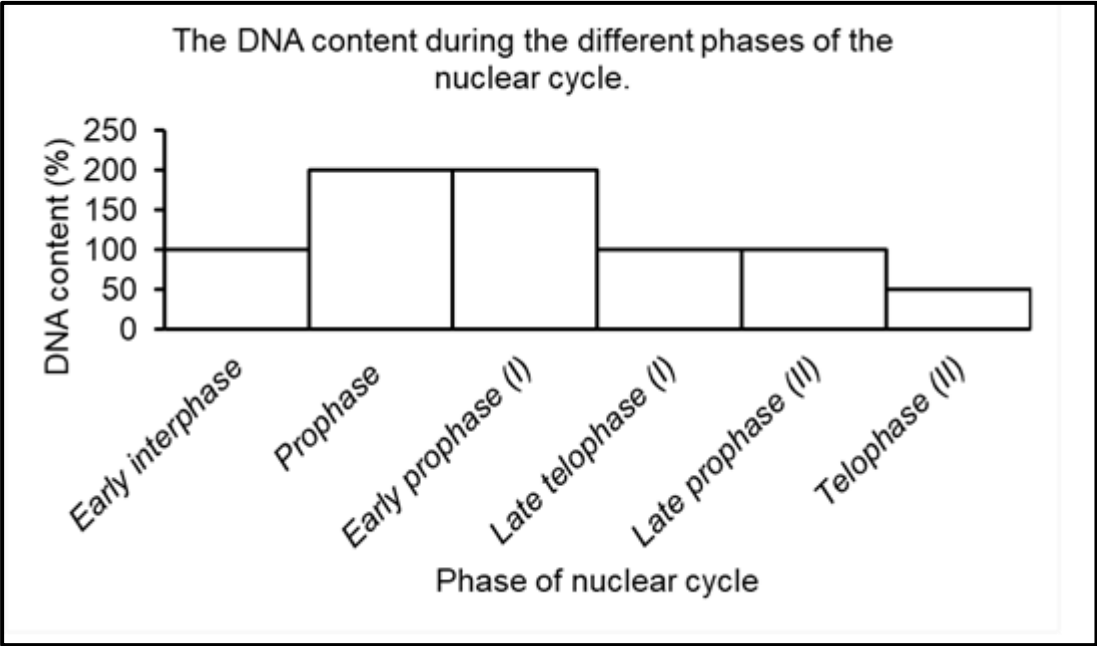
1.1	1.1.1	B ✓✓		
	1.1.2	A ✓✓		
	1.1.3	D ✓✓		
	1.1.4	D ✓✓		
	1.1.5	A ✓✓		
	1.1.6	C ✓✓		
	1.1.7	C ✓✓		
	1.1.8	A ✓✓		
	1.1.9	C ✓✓		
	1.1.10	B ✓✓	(10 x 2)	(20)
1.2	1.2.1	Cytokinesis ✓		
	1.2.2	Genome ✓		
	1.2.3	Haemophilia ✓		
	1.2.4	Homologous structures ✓		
	1.2.5	Continuous ✓ variation		
	1.2.6	Homologous chromosomes ✓		
	1.2.7	Theory ✓		
	1.2.8	Phenotype ✓		
	1.2.9	Spindle fibres ✓/spindle threads/spindle fibrils		
	1.2.10	Allele ✓ (not multiple alleles)	(10 x 1)	(10)
1.3	1.3.1	A only ✓✓		
	1.3.2	Both A and B ✓✓		
	1.3.3	None ✓✓	(3 x 2)	(6)
1.4	1.4.1	(a) B – Adenine ✓		(1)
		(b) C – deoxyribose ✓ sugar		(1)
		(c) D – phosphate ✓ molecule		(1)
	1.4.2	(weak) hydrogen ✓/H bond		(1)
	1.4.3	Interphase ✓		(1)
				(5)

1.5	1.5.1	- Identify bodies ✓/victims of disasters/crime - Identify inherited disorders ✓/organ donor - Identify criminal suspect ✓/forensic evidence pointing to possible suspect/exonerate falsely accused individuals - Identify different pathogens ✓/strands of viruses and bacteria - Identify animal/plants species ✓/manage conservation - Trace family history ✓/discover family relationships /genealogy - Trace wildlife populations ✓ (Mark first TWO only)	(2)
	1.5.2	Genes ✓/alleles	(1)
	1.5.3	Mia ✓	(1)
			(4)
1.6	1.6.1	Gene ✓ mutation	(1)
	1.6.2	46 ✓ chromosomes/23 (chromosome) pairs	(1)
	1.6.3	Males ✓	(1)
	1.6.4	$X^K X^k$ ✓✓	(2)
			(5)
TOTAL SECTION A:			50

SECTION B**QUESTION 2**

- 2.1 2.1.1 (a) **A** – nucleus ✓ (1)
 (b) **B** – mRNA ✓/messenger RNA (1)
 (c) **C** – ribosome ✓ (1)
 (d) **1** – transcription ✓ (1)
- 2.1.2 - Carries hereditary characteristics ✓
 - Controls the function of cells ✓
 - Controls the synthesis (making/producing) of proteins ✓/
 acts as a template for formation of mRNA
(Mark first ONE only) Any 1 (1)
- 2.1.3 (James) Watson, (Francis) Crick and (Maurice) Wilkens ✓✓ (2)
- 2.1.4 - Translation ✓*
 - Each tRNA carries a **specific** amino acid. ✓
 - When the anticodon on the tRNA ✓
 - **matches** the codon on the mRNA ✓
 - Then tRNA brings the required amino acid to the ribosome. ✓
 - Amino acids become attached to each other by peptide bonds ✓
 - to form the **required** protein. ✓
 *1 compulsory mark + Any 5 (6)
(13)
- 2.2 2.2.1 - Production of **haploid** gametes ✓/cells
 - The halving effect of meiosis overcomes the doubling effect of fertilisation ✓/maintaining a constant chromosome number
 - Contributes to/ensures genetic variation ✓
(Mark first THREE only) (3)

2.2.2



Guideline for assessing the graph:

SKILL	SYMBOL	MARK
Type of graph: histogram	T	1
Caption for graph: includes both variables - The relative amounts of DNA during mitosis and meiosis - The DNA content during the different phases of the nuclear cycle	C	1
Scale for Y-axis and width of bars on X-axis	S	1
Label for X-axis: Label and names of phases (accept if given in a key)	L	1
Label for Y-axis: Label and unit		
Drawing of bars	B	1: 1–5 correct bars 2: All bars correct

NOTE:

If the wrong type of graph is drawn:	- Marks will be lost for type (T)	
If axes are transposed:	-Marks will be lost for labeling (L)	
	-Marks will be lost for scale (S)	(6)

- 2.2.3
- (a) - DNA replication will take place ✓
- and the DNA content will double ✓/100 to 200
(not increase) (2)
- (b) - The number of chromosomes will be halved ✓/ 100 to 50
chromosome pairs split (divide)
- during anaphase I ✓ /anaphase of meiosis I (2)
(13)

2.3

2.3.1

(a) rr ✓
(b) Rr ✓

(1)
(1)

2.3.2

50 ✓%

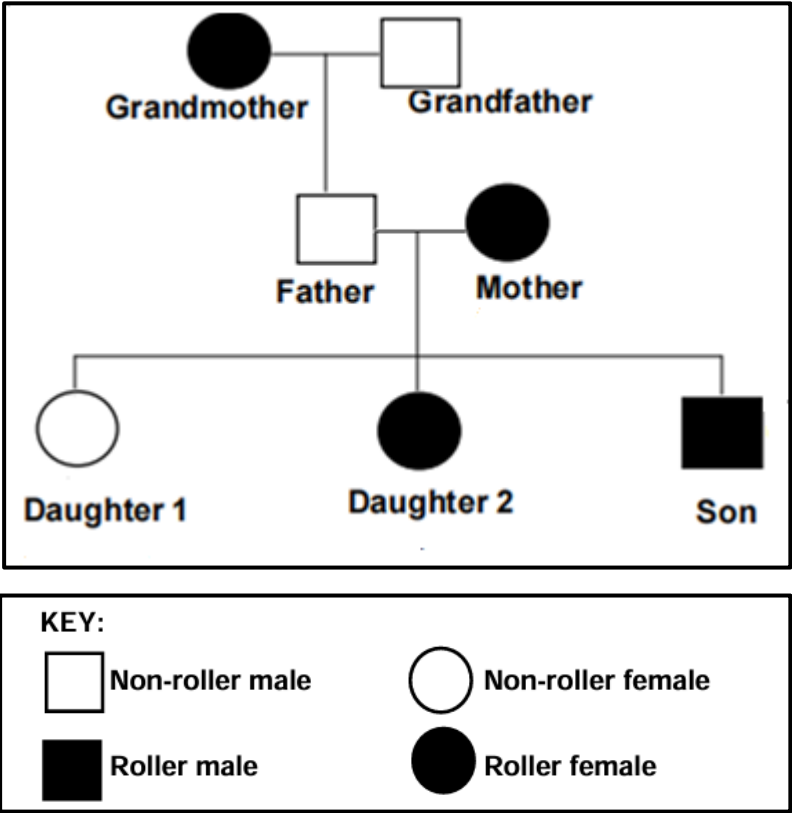
(1)

2.3.3

Complete ✓ dominance

(1)

2.3.4



Guideline for assessing the pedigree diagram:

SKILL	SYMBOL	MARK
Generation 1: Correct shapes and shading of connected grandparents	G	1
Generation 2: Correct shapes and shading of connected parents	P	1
Generation 3: Correct shapes and shading of connected children	C	1
Names of all individuals supplied OR No names given: Key included OR Correct caption	N	1

(4)
(8)

- 2.4 2.4.1 - An organism possesses two alleles ✓/'factors' which separate (segregate) so that
- each gamete contains only one of these alleles ✓/'factors' (2)
- 2.4 2.4.2 Autosomes ✓ (1)
- 2.4.3 Male ✓ (1)
- 2.4.4 - The gonosomes ✓/chromosome pair number 23
- are not identical ✓/XY
OR
- There is a Y ✓/smaller chromosome
- at 23rd ✓ position/pair (2)
- 2.4.5 - During Anaphase ✓(1 or 2)
- the chromosomes pair number 23 ✓/gonosomes
- of the (female/male) parent does not separate ✓/there is non-disjunction in the person/parent
- A **gamete** with XX ✓/XY-chromosome formed ✓.
- During fertilisation the abnormal gamete/sperm/ovum fused with a normal gamete/sperm/ovum ✓
- to form the **zygote** with XXY ✓/47 chromosomes Any 4 (4)
(10)

2.5 P₁ phenotype (Blood group) AB X (blood group) A ✓
Do not refer to heterozygous/homozygous

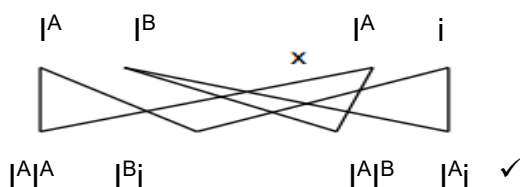
genotype
Meiosis

I^AI^B X I^Ai ✓

Gametes/G

Fertilisation

F₁ genotype



F₁ phenotype

(2/50%) blood group **A**
(1/25%) blood group **B**
(1/25%) blood group **AB** ✓

P₁ and F₁ ✓

Meiosis and fertilisation ✓

Any 6

OR

P₁ phenotype (Blood group) AB X (blood group) A ✓
Do not refer to heterozygous/homozygous

genotype

I^AI^B X I^Ai ✓

Meiosis

Fertilisation

Gametes	I ^A	I ^B
I ^A	I ^A I ^A	I ^A I ^B
i	I ^A i	I ^B i

1 mark for correct gametes
1 mark for correct genotypes

F₁ phenotype

(2/50%) blood group **A**
(1/25%) blood group **B**
(1/25%) blood group **AB** ✓

P₁ and F₁ ✓

Meiosis and fertilisation ✓

Any 6 (6)
[50]

QUESTION 3

- 3.1 - The insulin producing gene is cut/isolated from the DNA of a human/ healthy pancreas ✓ and
 - is inserted into the gene of bacterial DNA ✓/DNA of *E. coli*/plasmid
 - this is recombinant DNA ✓/this bacterium is genetically modified
 - and causes the bacterium/E. coli/culture to produce insulin ✓ (4)
- 3.2 3.2.1 *Homo sapiens* ✓ (1)
- 3.2.2 (Skull) **B** ✓ (1)
- 3.2.3 - Allows total awareness ✓ of the environment/sees further over high grass
 to sense danger ✓/look for food
 - Enables hands to be free ✓
 to use implements ✓/carry objects/protect offspring
 - Exposes a large surface area ✓
 for thermoregulation ✓/losing body heat to surroundings in hot conditions/reduces overheating/uses less water
 - Small surface area exposed to the sun, ✓
 reducing overheating ✓/use less water
 - Displays (male/female) sex organs ✓
 as part of courtship behaviour ✓
(Mark first THREE only) Any 3 x 2 (6)

3.2.4

(Organism) A/Gorilla	(Organism) B/Homo Sapiens/ Humans
Cranial ridge ✓ present	No cranial ridge ✓ present
Small(er) cranium ✓	Large(r) cranium ✓ (Not 'brain/skull')
Browridge well developed ✓	Browridge less developed ✓ (Not 'no browridge')
Large/well developed canines ✓ /fangs	Small/underdeveloped canines ✓ /no fangs
Jaws are prognathous ✓/Longer jaws/More protruding jaws	Jaws are non-prognathous ✓/ Shorter jaws/Less protruding jaws (Not 'less prognathous')
More pronounced zygomatic arches ✓	Less pronounced zygomatic arches ✓
Foramen magnum is more backward ✓	Foramen magnum is more forward ✓
Sloping face ✓/forehead	Flat face ✓/forehead

(Mark first THREE only)1 ✓ Table + Any 3 x 2 (7)
(15)

- 3.3 3.3.1 - The change in characteristics of a species ✓
- over time ✓ (2)
- 3.3.2 - Squirrels with sparse hair ✓ resulted
in lower(cooler) body temperatures ✓
- Good digging claws ✓
enabled them to dig (make tunnels) in the deep/cool sand. ✓ (4)

- 3.3.3
- The original/ancestral **population** of the (ground) squirrels ✓
 - became separated by the canyon ✓*/Grand Canyon/deep eroded Colorado River
 - the population split into two ✓/divided into a north and south population
 - the squirrels stopped crossing the canyon because there was no shelter ✓/shade/temperature too high/desert habitat
 - there is no gene flow between the north and south population ✓/between the two squirrel populations
 - In the south side it was warmer, with less shade ✓/the squirrels were exposed to heat
 - in the north side it was cooler with more shade ✓/the squirrels were less exposed to heat/the exposure to heat differed in the north and south side
 - natural selection occurs independently in each of the two populations ✓
 - such that the individuals of the two populations **become different** ✓ from each other
 - genotypically and phenotypically ✓
 - even if the two populations were to mix again ✓
 - they will not be able to interbreed ✓
 - the two populations are the Abert and Kaibab squirrels ✓/are different species

*1 compulsory mark + Any 7 (8)

- 3.3.4
- Breeding at different times of the year ✓
 - Species-specific courtship behavior ✓
 - Plant adaptation to different pollinators ✓
 - Infertile offspring ✓

(Mark first TWO only)

Any 2 (2)

- 3.4
- There is a great deal of variation amongst the offspring ✓
 - Some had favourable characteristics and some did not ✓
 - There is a change in the environmental conditions ✓
 - Whilst organisms with unfavourable characteristics, which made them less suited, died ✓
 - Whilst organisms with favourable characteristics made them more suited, survived ✓ and
 - Reproduce(d) ✓
 - the allele for favourable characteristic is passed on to their offspring ✓
 - The next generation will therefore have a higher proportion of individuals with the favourable characteristics ✓

Any 7 (7)

- 3.5 3.5.1 (a) (Exposure to) DDT ✓/insecticide (1)
- (b) Resistance of mosquitoes ✓ (1)
- 3.5.2 (a) - **Decide on** the duration ✓ of the investigation
- **Decide on** the area ✓ to capture mosquitoes
 - **Decide on** the sample size ✓
 - **Decide on** date ✓/time of capturing mosquitoes
 - **Decide on** the concentration of DDT ✓ used
 - **Decide how** long the mosquitoes must be exposed to DDT ✓
 - **Decide how** to record the results ✓/on the form to record the results
 - **Decide on** type of mosquitoes ✓/species of mosquitoes
 - **Ask permission** ✓ (from authorities/land-owner) to conduct the investigation
 - **Select** apparatus ✓ to capture mosquitoes
 - **Train** research assistants ✓
- (Mark first TWO only) Any 2 (2)
- (b) - **Same** time (1 hour per day) ✓ for the duration of the investigation
- **Same** laboratory conditions ✓ for the full period of the investigation
 - **Same** dose (4%) of DDT ✓ for the full period of the investigation
 - **All** mosquitos must be healthy ✓ for the full period of the investigation
- (Mark first TWO only) Any 2 (2)
- (c) - Mosquitoes developed a resistance to DDT ✓✓/
resistance to DDT will increase over time

OR

- DDT is an not an effective insecticide to control the spread of mosiquitoes ✓✓ (2)
- (8)**
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150



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**PROVINSIALE VOORBEREIDENDE EKSAMEN/
PROVINCIAL PREPARATORY EXAMINATION**

GRAAD 12/GRADE 12

LEWENSWETENSKAPPE/LIFE SCIENCES

VRAESTEL/PAPER 2

SEPTEMBER 2025

PUNTE/MARKS: 150

TYD/TIME: 2½ uur/hours

**Hierdie vraestel bestaan uit 16 bladsye./
This question paper consists of 16 pages.**

Kopiereg voorbehou/Copyright reserved

Blaai om asseblief/Please turn over

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 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.

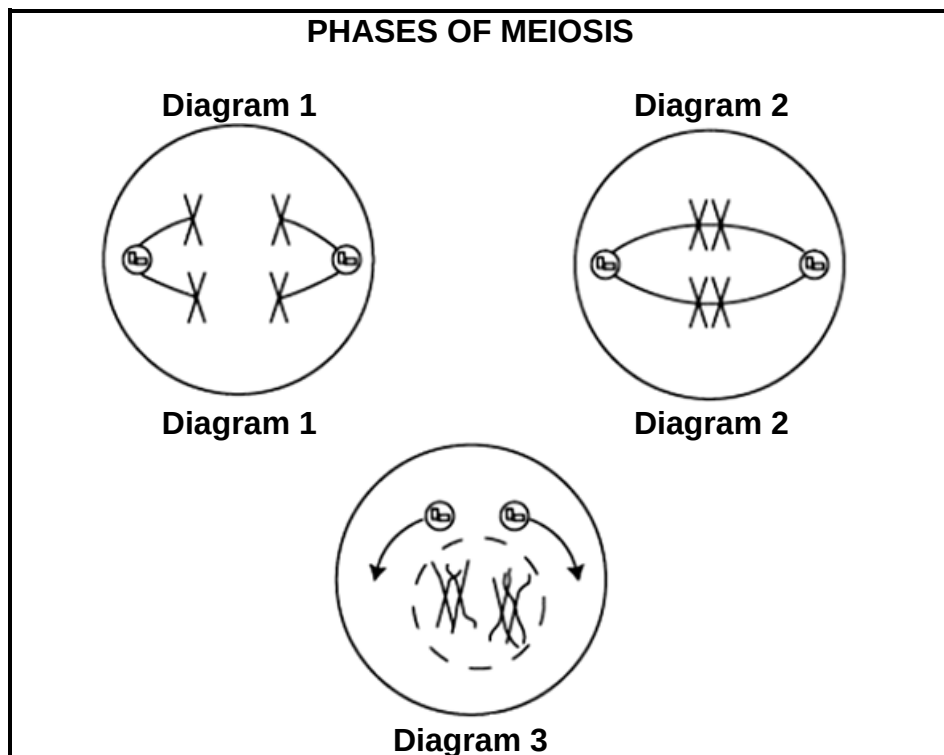
1.1.1 DNA is found in the...

- A nucleolus.
- B chromatin network.
- C ribosomes.
- D cytoplasm.

1.1.2 The present-day distribution of organisms is referred to as ...

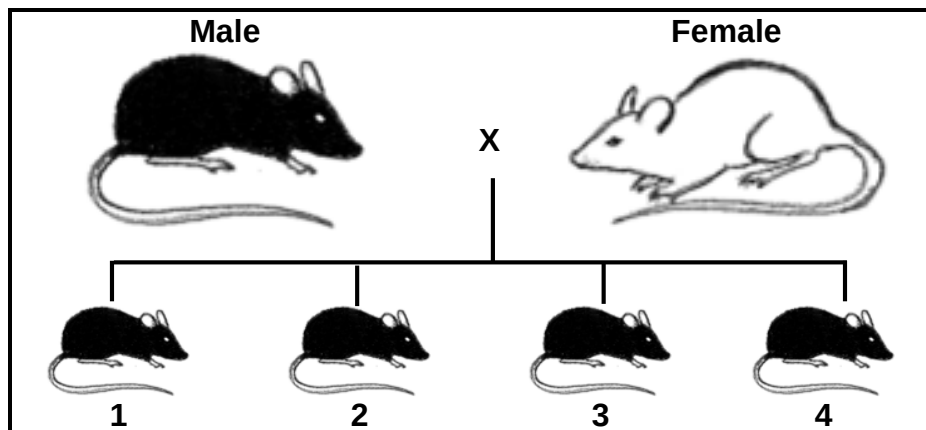
- A biogeography.
- B biodiversity.
- C biochemistry.
- D mutations.

1.1.3 The correct sequence for the part of meiosis I shown below is ...



- A Diagram 1, Diagram 2, Diagram 3
- B Diagram 2, Diagram 3, Diagram 1
- C Diagram 3, Diagram 1, Diagram 2
- D Diagram 3, Diagram 2, Diagram 1

- 1.1.4 The diagram below shows a crossing between a homozygous black mouse and a homozygous white mouse.



The possible genotypes for the mice are:

- (i) BB
- (ii) Bb
- (iii) bb

The genotype for the offspring is ...

- A Only (i)
- B Only (i) and (ii)
- C Only (ii) or (iii)
- D Only (ii)

- 1.1.5 Give the sequence of nitrogenous bases on the mRNA molecule that the following part of a DNA strand codes for:

GAT CCA

- A CUA GUU
- B CTA GTT
- C AGC TGG
- D AGC UGG

- 1.1.6 DNA was taken from the cells of *Saccharomyces cerevisiae* and tested for its nitrogen bases. It was found that 17% of the bases are cytosine. What percentage of the bases are adenine?

- A 17
- B 34
- C 33
- D 51

1.1.7 Which ONE on the following evidence supports the 'Out-of-Africa' hypothesis by tracing the maternal lineage?

- A Y chromosome
- B X chromosome
- C Mitochondrial DNA
- D Cultural evidence

QUESTIONS 1.1.8 TO 1.1.10 ARE BASED ON THE DIHYBRID CROSSING BELOW.

DIHYBRID CROSSING IN WOLVES

Fur colour in wolves is controlled by two alleles, grey (**G**) and black (**g**). Eye colour is controlled by two alleles, yellow (**Y**) and blue (**y**).

The following combinations represent possible phenotypic traits observed in wolves:

- (i) Grey fur with yellow eyes
- (ii) Black fur with blue eyes
- (iii) Black fur with yellow eyes
- (iv) Grey fur with blue eyes

1.1.8 If the male wolf has the genotype **GgYY** and the offspring has the genotype **ggYY**, which ONE of the above combinations could represent the phenotype of the she-wolf?

- A Only (i) and (iii)
- B Only (i) and (ii)
- C Only (ii) and (iv)
- D Only (iii) and (iv)

1.1.9 Give the genotype of a black wolf with blue eyes.

- A GgYy
- B ggYY
- C ggyy
- D Ggyy

1.1.10 Which ONE of the following represents the gametes produced by a black wolf with yellow eyes?

- A Gy ; gY
- B gY ; gy
- C gg ; Yy
- D GY ; gy

(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 1.2.10) in the ANSWER BOOK.

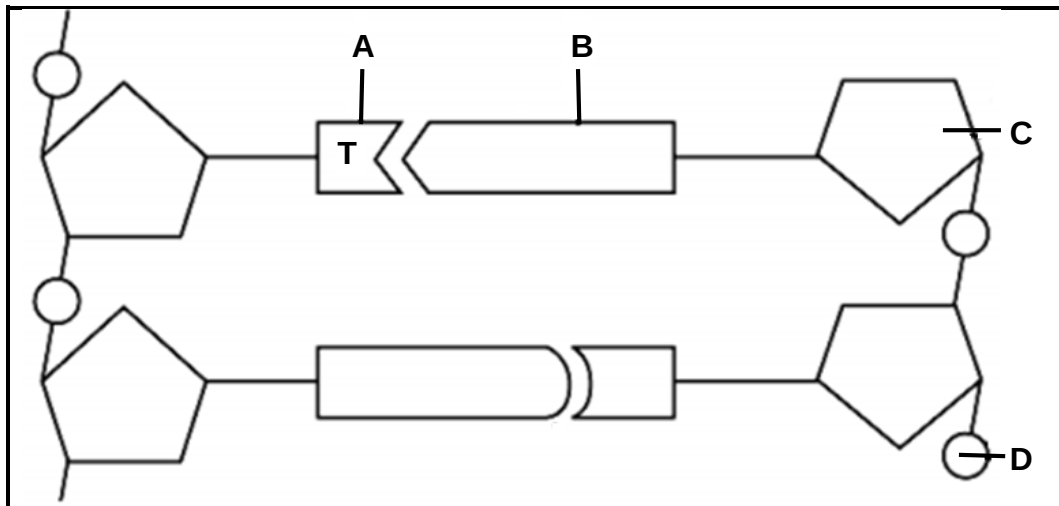
- 1.2.1 The division of the cytoplasm during cell division
- 1.2.2 All the genes of a particular species
- 1.2.3 The inability of blood to clot due to lack of a blood clotting factor
- 1.2.4 Similar structures that descend from a common ancestor
- 1.2.5 The type of variation which has a range of intermediate phenotypes for a particular trait
- 1.2.6 A pair of chromosomes, one inherited from each parent, that have the same genes at the same loci
- 1.2.7 An explanation for something that has been observed in nature, and which can be supported by facts, laws and tested hypotheses
- 1.2.8 The physical and functional expression of a gene
- 1.2.9 A network of filaments which are formed during both mitosis and meiosis that help in the movement of chromosomes
- 1.2.10 Different forms of a gene which occur at the same locus on homologous chromosomes (10 x 1) **(10)**

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 numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II
1.3.1	Organisms have an inherent/internal drive to change	A: Lamarck B: Darwin
1.3.2	Influences the inheritance of blood groups	A: Co-dominance B: Multiple alleles
1.3.3	Mutation that increases biodiversity	A: Neutral B: Lethal

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

1.4 The diagram below represents a short section of a DNA molecule.



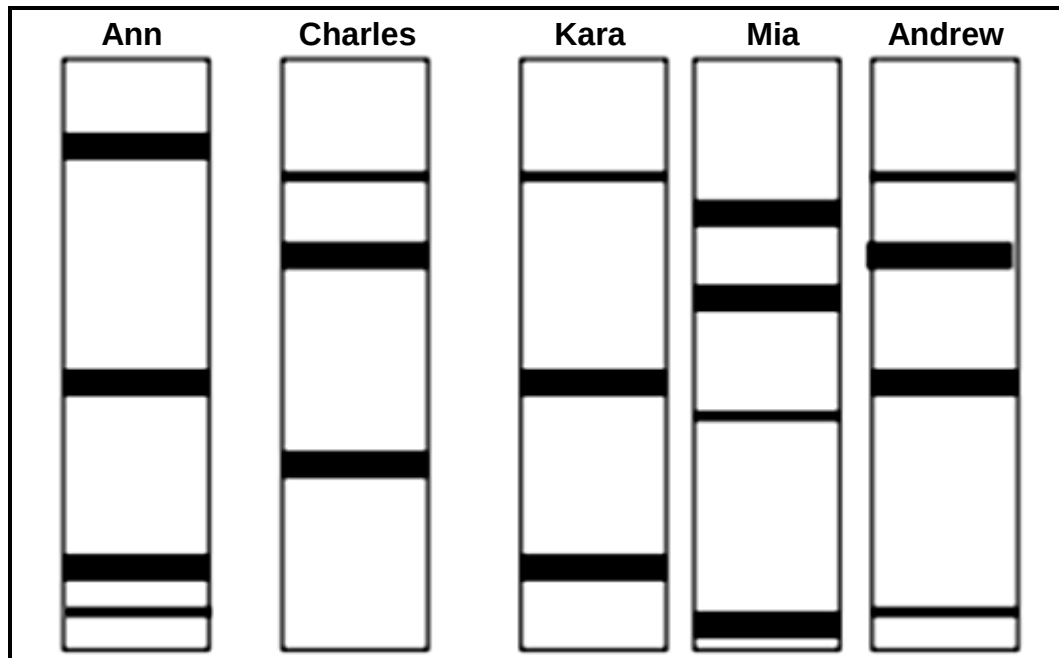
1.4.1 Identify:

- (a) The full name for nitrogenous base **B** (1)
- (b) Molecule **C** (1)
- (c) Molecule **D** (1)

1.4.2 Name the type of bond that joins **A** to **B**. (1)

1.4.3 During which phase of the cell cycle will an identical copy of this molecule be made? (1)
(5)

- 1.5 The diagram below represents the DNA profiles of three children (Kara, Mía and Andrew) and their parents (Ann and Charles). Only two of the children are the parents' biological children and one is adopted.

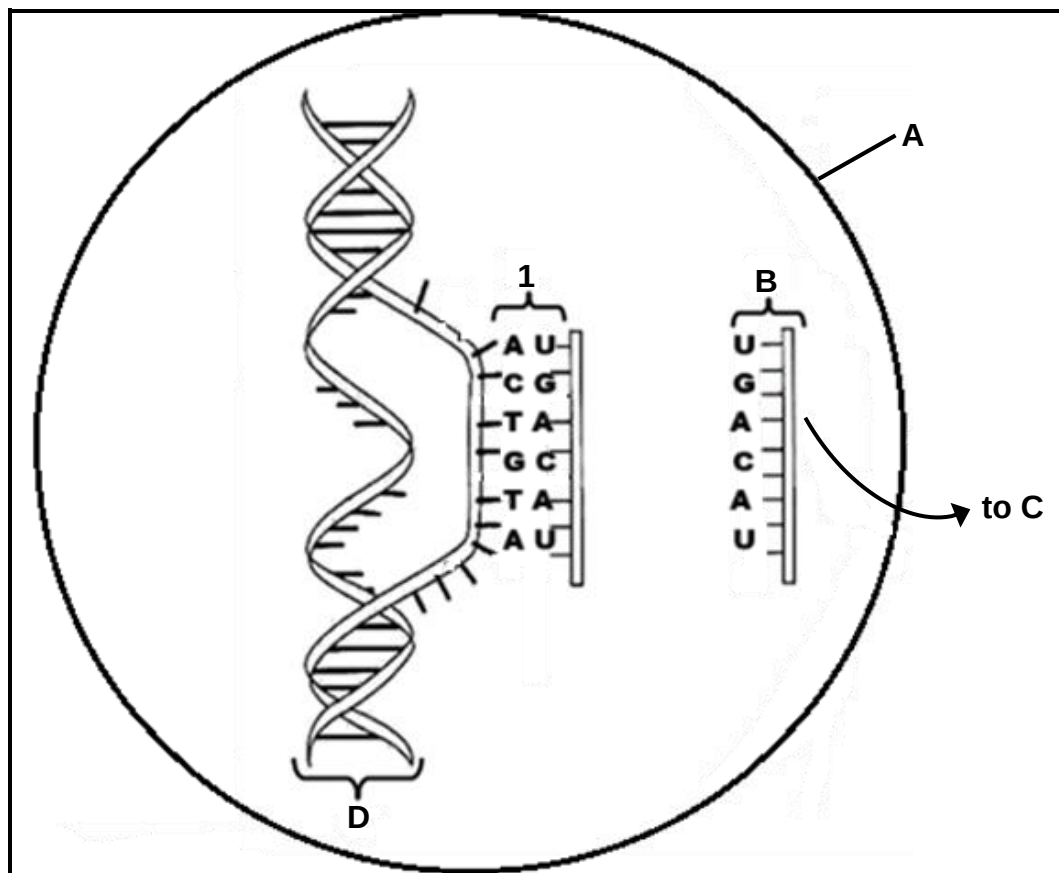


- 1.5.1 Give TWO other ways in which DNA-profiling is used. (2)
- 1.5.2 What do the black bars in the DNA profiles represent? (1)
- 1.5.3 Which ONE of the children has been adopted? (1)
(4)
- 1.6 McLeod Syndrome is a disorder that affects red blood cells and may also result in red-green colour blindness. Use the allele X^k to express this condition.
- 1.6.1 What type of mutation leads to colour blindness? (1)
- 1.6.2 How many chromosomes will a person with colour blindness have in each somatic cell? (1)
- 1.6.3 Which gender is more likely to have this disorder? (1)
- 1.6.4 Give the genotype of a carrier for colour blindness. (2)
(5)

TOTAL SECTION A: 50

SECTION B**QUESTION 2**

2.1 The diagram below represents protein synthesis.



2.1.1 Identify:

- (a) Organelle **A** (1)
- (b) Structure **B** (1)
- (c) Organelle **C** (1)
- (d) Process **1** (1)

2.1.2 Give ONE function of molecule **D**. (1)

2.1.3 Name ALL THREE scientists who received the Nobel Prize in 1962 for discovering the molecular shape of molecule **D**. (2)

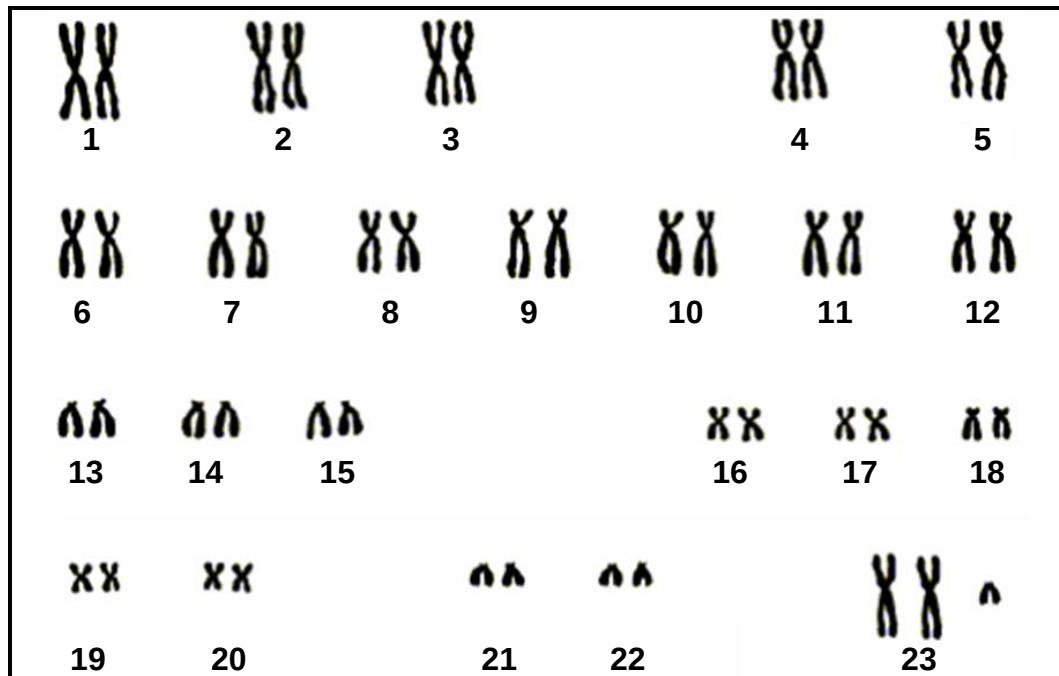
2.1.4 Name and describe the process that occurs at organelle **C**. (6)
(13)

- 2.2 The relative amounts of DNA were measured in the cells of a domestic dog during mitosis and meiosis. The results are shown in the table below.

PHASE OF NUCLEAR CYCLE		DNA CONTENT (%)
Mitosis	Early interphase	100
	Prophase	200
Meiosis I	Early prophase	200
	Late telophase	100
Meiosis II	Late prophase	100
	Telophase	50

- 2.2.1 Give THREE reasons why meiosis is biologically important. (3)
- 2.2.2 Using the information in the table, draw a histogram representing the DNA content during the different phases of the nuclear cycle. (6)
- 2.2.3 Explain the following:
- (a) The amount of DNA in early interphase differs from the amount of DNA in prophase. (2)
- (b) Early prophase of meiosis I has a different amount of DNA than late prophase of meiosis II. (2)
- (13)**

- 2.4 The diagram below represents a karyotype of a somatic cell of a human with a genetic disorder called Klinefelter syndrome. Klinefelter syndrome affects the sex chromosomes.



- 2.4.1 What is Mendel's principle of segregation? (2)
- 2.4.2 Give the collective term for the chromosomes numbered 1 to 22. (1)
- 2.4.3 Identify the gender of the individual represented in the diagram. (1)
- 2.4.4 Give ONE visible reason for your answer to QUESTION 2.4.3. (2)
- 2.4.5 Use your knowledge of abnormal meiosis to explain how Klinefelter syndrome is caused. (4)
- (10)**
- 2.5 The ABO system classifies human blood groups into four types: A, B, AB and O.
- A woman with heterozygous blood group A marries a man with blood group AB. Use a genetic cross to show the possible blood groups of their offspring. (6)
- [50]**

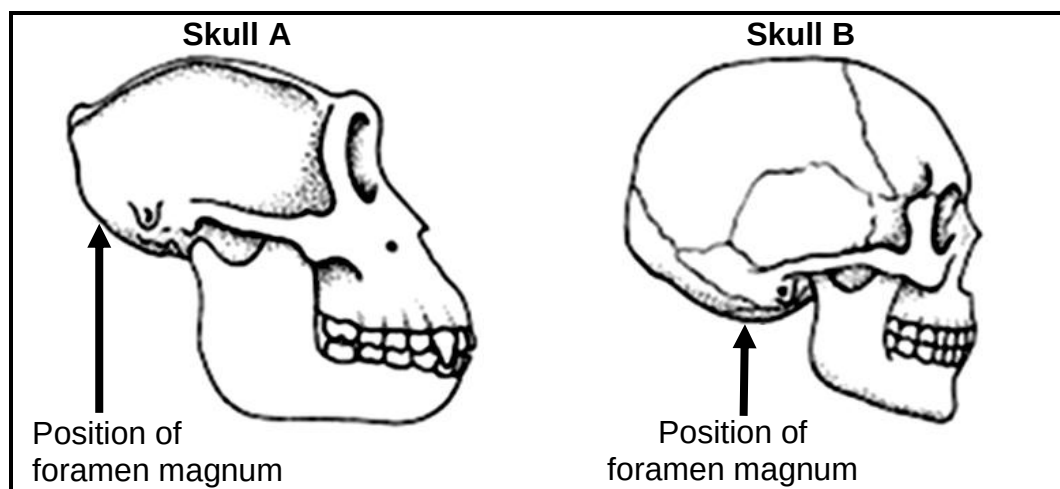
QUESTION 3

- 3.1 Insulin is a hormone used to regulate blood sugar levels. People with Type 1 diabetes do not produce insulin and rely on insulin injections. Modern biotechnology makes it possible to produce human insulin. Genetically modified bacteria is used to produce insulin on a large scale.

Give FOUR steps in the production of insulin using recombinant DNA technology.

(4)

- 3.2 The diagrams below represent the skulls of two organisms, namely a gorilla and a modern human. Each arrow indicates the position of the foramen magnum. The diagrams are not drawn to scale.



- 3.2.1 Give the scientific name of the organism with skull **B**.
- 3.2.2 Which skull (**A** or **B**) represents a bipedal organism?
- 3.2.3 Explain THREE possible advantages of bipedalism.
- 3.2.4 Tabulate THREE visible differences between skull **A** and **B** as illustrated in the diagram above.

(1)

(1)

(6)

(7)

(15)

3.3 Read the passage below.

THE EVOLUTION OF THE GRAND CANYON SQUIRRELS

In the southwestern part of the United States, there are two kinds of similar ground squirrels, the Abert and the Kaibab ground squirrels. It is believed that they shared a common ancestor 10 000 years ago.

As time passed in their desert habitat, the Colorado River continued to erode deeper into the ground, eventually forming a big canyon. This canyon was very deep, and the squirrels stopped crossing the canyon.

Over time the habitat to the north of the canyon became more shaded and the vegetation increased since it wasn't as hot. To the south of the canyon, the area became warmer with less shade. Squirrels with sparse hair and good digging claws were able to make tunnels to reach the deeper, cooler sand. These squirrels reproduced successfully.

[Source: https://en.wikipedia.org/wiki/Kaibab_squirrel]

- 3.3.1 Define the term *biological evolution*. (2)
- 3.3.2 Explain the favourable adaptations of the Abert squirrel living on the southern side of the canyon. (4)
- 3.3.3 Describe the speciation of the Abert and Kaibab squirrels. (8)
- 3.3.4 Name TWO other types of reproductive isolating mechanisms. (2)
- (16)**
- 3.4 Describe the process of natural selection. (7)

- 3.5 Scientists investigated the resistance of mosquitoes to the insecticide DDT over a period of 16 months.

The procedure was as follows:

- Mosquitoes were collected in a natural environment
- The mosquitoes which were collected were kept in a controlled environment in an insect laboratory.
- The laboratory provided suitable living conditions such as temperature, humidity and food to ensure that the mosquitoes stayed alive and healthy so that they could reproduce.
- Every day, the mosquitoes were exposed to **4% DDT** for **1 hour**.
- Every **2 months**, the scientists tested a sample of the mosquitoes to check whether they were becoming resistant to DDT.
- Resistance was measured by observing how many mosquitoes survived the DDT exposure.
- A high number of deaths shows low resistance.
- Percentage mortality was calculated as follows:

$$\frac{\text{Number of mosquitoes that died}}{\text{Total number of mosquitoes tested}} \times \frac{100}{1}$$

The results are shown in the table below.

MORTALITY RATE OF THE MOSQUITOES OVER A PERIOD OF 16 MONTHS	
TIME (in months)	MORTALITY OF MOSQUITOES (%)
0	95
2	87
4	80
6	69
8	60
10	54
12	35
14	27
16	22

- 3.5.1 Identify the:

- (a) Independent variable (1)
- (b) Dependent variable (1)

3.5.2 State:

- (a) TWO planning steps that the investigators had to take before the investigation was conducted (2)
 - (b) TWO ways in which the validity of this investigation was ensured (2)
 - (c) The conclusion for this investigation (2)
- (8)**
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150



education

MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

**NATIONAL SENIOR
CERTIFICATE**

GRADE 12

LIFE SCIENCES P2
SEPTEMBER 2025
MARKING GUIDELINES
(AMENDED)

MARKS: 150

These marking guidelines consist of 13 pages.

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PRINCIPLES RELATED TO MARKING LIFE SCIENCES

1. **If more information than marks allocated is given**
Stop marking when maximum marks is reached and put a wavy line and 'max' in the right-hand margin.
2. **If, for example, three reasons are required and five are given**
Mark the first three irrespective of whether all or some are correct/incorrect.
3. **If whole process is given when only a part of it is required**
Read all and credit relevant part.
4. **If comparisons are asked for and descriptions are given**
Accept if differences / similarities are clear.
5. **If tabulation is required but paragraphs are given**
Candidates will lose marks for not tabulating.
6. **If diagrams are given with annotation when descriptions are required**
Candidates will lose marks.
7. **If flow charts are given instead of descriptions**
Candidates will lose marks.
8. **If sequence is muddled and links do not make sense**
Where sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If sequence and links become correct again, resume credit.
9. **Non-recognised abbreviations**
Accept if first defined in answer. If not defined, do not credit the unrecognised abbreviation but credit the rest of answer if correct.
10. **Wrong numbering**
If answer fits into the correct sequence of questions but the wrong number is given it is acceptable.
11. **If language used changes the intended meaning**
Do not accept.
12. **Spelling errors**
If recognisable accept the answer provided it does not mean something else in Life Sciences or if it is out of context.
13. **If common names are given in terminology**
Accept provided it is accepted at the provincial memo discussion meeting
14. **If only letter is asked for and only name is given (and vice versa)**
Do not credit.

NSC- Marking Guidelines

15. If units are not given in measurements

Candidates will lose marks. Memorandum will allocate marks for units separately

16. Be sensitive to the sense of an answer, which may be stated in a different way.**17. Caption**

All illustrations (diagrams, graphs, tables, etc.) must have a caption.

18. Code-switching of official languages (terms and concepts)

A single word or two that appears in any official language other than the learners' assessment language used to the greatest extent in his/her answers should be credited, if it is correct.

19. Changes

No changes must be made to the marking guidelines without consulting the Provincial Internal Moderator.

NSC- Marking Guidelines

SECTION A**QUESTION 1**

1.1	1.1.1	B✓✓		
	1.1.2	C✓✓		
	1.1.3	A✓✓		
	1.1.4	D✓✓		
	1.1.5	C✓✓		
	1.1.6	B✓✓		
	1.1.7	B✓✓		
	1.1.8	D✓✓		
	1.1.9	B✓✓		
	1.1.10	C✓✓	(10 x 2)	(20)
1.2	1.2.1	Ribose✓sugar		
	1.2.2	Peptide✓bond		
	1.2.3	Interphase✓		
	1.2.4	Cytokinesis✓		
	1.2.5	Colour blindness✓		
	1.2.6	Codominance✓		
	1.2.7	Genome✓		
	1.2.8	Cultural✓ evidence		
	1.2.9	Cradle of human kind✓		
	1.2.10	Prognathism✓	(10 x 1)	(10)
1.3	1.3.1	None✓✓		
	1.3.2	Both A and B✓✓		
	1.3.3	A only✓✓	(3 x 2)	(6)
1.4	1.4.1	Out of Africa✓ hypothesis		(1)
	1.4.2	In Africa✓		(1)
	1.4.3	<i>Homo erectus</i> ✓		(1)
	1.4.4	40 000 years ago✓		(1)
	1.4.5	South America✓		(1)
	1.4.6	Ardipithecus✓ Australopithecus✓	Any order	(2) (7)

NSC- Marking Guidelines

1.5	1.5.1	Rrgg✓✓ rrGg✓✓	(4)
	1.5.2	(a) black eyes✓ and white feathers✓	(2)
		(b) $\left. \begin{array}{l} rG \\ rg \end{array} \right\} \checkmark$	(1)
			(7)
TOTAL SECTION A:			50

SECTION B**QUESTION 2**

- 2.1 2.1.1 Allows the mRNA to move out of the nucleus to the ribosomes✓/cytoplasm (1)
- 2.1.2 A part of a DNA molecule that acts as a pattern for the building of mRNA✓/another DNA molecule
OR
 The part of DNA that codes for a protein✓ (1)
- 2.1.3 CGT✓ (1)
- 2.1.4
- Process A/**Transcription** taking place in the nucleus✓
 - Process B/**Translation** taking place in the cytoplasm✓
 - Process A/**Transcription** produces mRNA✓
 - Process B/**Translation** produces amino acid chain/polypeptide/protein✓
 - Process A/**Transcription** starts with DNA✓
 - Process B/**Translation** starts with mRNA✓
 - Process A/**Transcription** does not use tRNA✓
 - Process B/**Translation** use tRNA✓
 - Process A/**Transcription** there are no amino acids joined together by peptide bond✓
 - Process B/**Translation** amino acids are joined together by peptide bond✓
 - Process A/**Transcription** has codons as base triplets✓
 - Process B/**Translation** has anticodons as base triplets✓
- (Mark first TWO only)** Any (2 x 2) (4)
- 2.1.5 (a) Alanine✓ (1)
 (b) Phenylalanine✓ (1)
- 2.1.6
- The codon ACA changed to AGA✓
 - The anticodon/tRNA sequence UGU changed to UCU✓
 - Both anticodons UCU and UGU code for the same amino acid cysteine✓
 - thus, the type of protein formed will not change/remain the same✓
- (4)
(13)

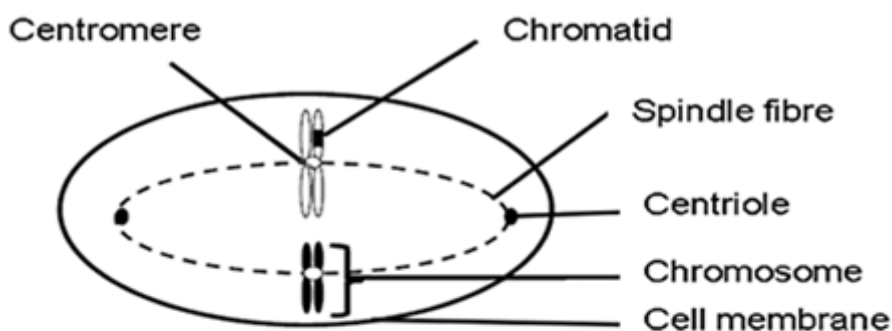
NSC- Marking Guidelines

2.2	2.2.1	DNA profiling✓	(1)
	2.2.2	Suspect 2✓	(1)
	2.2.3	- Eight/all of the DNA profile bands from suspect 2 are identical✓to/match/correspond with the DNA profile bands from the hair✓	(2)
	2.2.4	The DNA profile from the hair and from the skin shows completely different banding patterns✓✓/the DNA profile bands for hair and the skin are not the same	(2)
	2.2.5	- Proof of paternity✓ - Finding long lost relatives✓/tracing missing persons - Establishing family relations✓ - Identifying dead bodies✓/person/animals/organisms - Identifying fossils✓ - Identification/diagnosing of genetic disorders✓/genetic counselling - Finding matching tissues for organ transplants✓	
		(Mark first TWO only)	Any 2 (2) (8)

2.3 2.3.1 Metaphase I✓ (1)

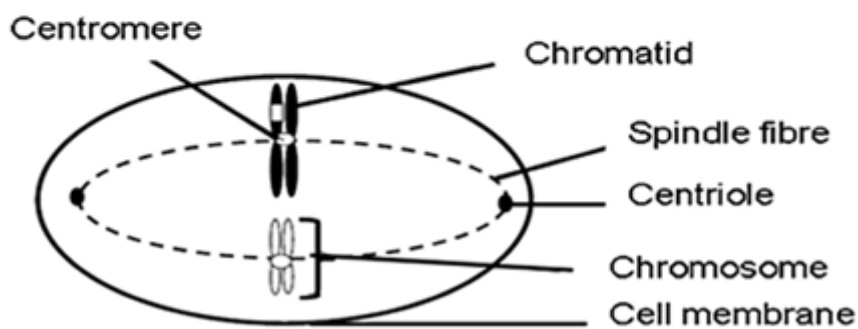
2.3.2 Anaphase I/meiosis I – Homologous chromosome pairs separate✓/
Chromosomes move to opposite poles
Anaphase II/ meiosis II – Chromosomes separate✓/ Chromatids move
to opposite poles (2)

2.3.3



Metaphase II

OR



Metaphase II

Description	Mark allocation
Caption (C)	1
TWO chromosomes drawn at the equator (D)	1
Shading, shape and size of chromosomes (S)	1
Any ONE correct label (L)	1

(4)

(7)

NSC- Marking Guidelines

2.4	2.4.1	Male✓		(1)
	2.4.2	No✓		(1)
	2.4.3	It has 39 chromosome pairs✓ instead of 23 chromosome pairs✓/ it has 78 chromosomes instead of 46		(2)
	2.4.4	Chromosomal✓*/chromosome mutation - There is a change in the number of chromosomes✓ - There is only ONE chromosome✓/one less chromosome/one chromosome short - Instead of two✓ - on chromosome pair number 6✓/six	*Compulsory + Any 3	(4) (8)
2.5	2.5.1	- Embryo✓/embryonic stem cell/foetal tissue - Umbilical cord✓/cord blood - Bone marrow✓ (Mark first ONE only)	Any 1	(1)
	2.5.2	- Stem cells are undifferentiated✓ - and have the potential to develop into any type of cell✓ - to replace affected/defective cells causing a disorder✓		(3)
	2.5.3	- Cells have the same DNA✓/genes/alleles - same antigens✓/tissue type/blood group - less risk of rejection✓/not rejected - no immune response by immune system✓/no need to take immunosuppressants✓ - No risk of infection/disease spread✓ (Mark first TWO only)	Any 2	(2) (6)
2.6	2.6.1	2✓/Two		(1)
	2.6.2	- Both alleles / I^A and I^B are equally dominant✓ - whereby both alleles express themselves in the phenotype✓ in the heterozygous condition		(2)
	2.6.3	- The man has an allele for blood group A✓/ is I^AI^B - The woman is heterozygous✓/ is I^Bi for blood group B - The child inherits the I^A✓/dominant allele from the father - and the i✓/recessive i from the mother - Therefore, the child will be heterozygous✓ for blood group A/the genotype will be I^Ai /the genotype I^A masks i		(5) (8) [50]

QUESTION 3

- 3.1 3.1.1 - A form of a gene✓
 - that is carried on chromosome 1-22✓and
 - is always expressed in the phenotype✓ of an individual
 - in the homozygous dominant or heterozygous✓ condition
 Any 2 (2)

- 3.1.2 - The couples had already reproduced children✓
 - Before symptoms appear✓/before knowing they have the disease/do not know have the disease
 - because it is hard to diagnose before symptoms appear✓ Any 2 (2)

3.1.3 P₁ Phenotype Man with Machado-Joseph x Woman without Machado-Joseph

Genotype Dd x dd✓

Meiosis
 G/Gametes D, d x d, d✓

Fertilisation
 F₁ Genotype Dd, Dd, dd, dd✓

Phenotype 2 with Machado-Joseph; 2 without Machado-Joseph
 50%✓* with Machado-Joseph

P₁ and F₁✓
 Meiosis and fertilisation✓

***compulsory mark + Any 5**

OR

P₁ Phenotype Man with Machado-Joseph x Woman without Machado - Joseph✓

Genotype Dd x dd✓

Meiosis

Fertilisation

Gametes	d	d
D	Dd	Dd
d	dd	dd
1 mark for correct gametes 1 mark for correct genotype		

F₁ Phenotype 2 with Machado-Joseph; 2 without Machado-Joseph
 50%✓* with Machado-Joseph

P₁ and F₁✓
 Meiosis and fertilisation✓

***compulsory mark+ Any 5**

(6)
(10)

NSC- Marking Guidelines

- 3.2 3.2.1 - A gene was cut/removed from the bacterial DNA✓/plasmid
 - and inserted into the chromosome/transfer gene to the chromosome /DNA of a mosquito✓
 - to produce/create the desired adult male mosquitoes✓ (3)
- 3.2.2 - Anopheles mosquito die out without the use of insecticides✓
 - Fewer mosquitoes biting or spreading Malaria✓
 - Fewer people get/die from Malaria✓
 - Lower medical costs✓ /less health care needed
 - Better economically for developing✓/tropical countries
(Mark first ONE only) Any 1 (1)
- 3.2.3 - Cloning: process of making (genetically) identical organisms✓
 - Genetic engineering: process whereby genes coding for the desired characteristic are inserted into an organism✓ (2)
(6)
- 3.3 3.3.1 Pangea✓ (1)
- 3.3.2 - The common ancestor *Panthera* "leo" became separated due to continental drift✓*/ by oceans
 - onto Gondwanaland and Laurasia✓
 - they split into four groups/populations✓
 - There is now no gene flow✓ between the four populations.
 - Since each population may be exposed to different environmental conditions✓/the selection pressure may be different
 - natural selection occurs independently✓ in each of the four populations
 - such that the individuals of the four populations become very different✓ from each other
 - genotypically and phenotypically✓.
 - Even if the four populations were to mix again ✓ they will not be able to interbreed✓
 - The four populations are now different species namely *Panthera leo*, *Panthera speiaaea*, *Panthera vereshchagini*, *Panthera afrox*✓*
*** 2 compulsory marks + any 5** (7)
(8)

NSC- Marking Guidelines

- 3.4 3.4.1 Plant adaptation to different pollinators✓ (1)
- 3.4.2 - Breeding at different times of the year✓
 - Species-specific courtship behaviour✓
 - Infertile offspring✓
 - Prevention of fertilisation✓
 - Habitat isolation✓
(Mark first TWO only) Any 2 (2)
- 3.4.3 Punctuated equilibrium✓ (1)
- 3.4.4 - Evolution involves long periods of time where species do not change✓ / change gradually through natural selection
 - This alternates with short periods of time where rapid changes occur✓ through natural selection
 - during which new species may form in a short period of time.✓
 Any 2 (2)
(6)
- 3.5 3.5.1 Is having ADHD advantages for foraging?✓✓
OR
 Does ADHD have an effect on foraging?✓✓
OR
 What effect does ADHD have on foraging?✓✓ (2)
- 3.5.2 - Obtain informed consent/permission from participants✓
 - Decide on sample size to be used✓
 - Decide on recruiting method✓
 - How will ADHD information be obtained from participants✓
(Mark first TWO only) Any 2 (2)
- 3.5.3 $506 \times \frac{43}{100} \checkmark = 217,58$ Thus 218✓ participants
OR
 $506 \times 43\% \checkmark = 217,58$ Thus 218 ✓participants (2)

NSC- Marking Guidelines

3.5.4

Number of berries collected by different groups of participants

Groups of participants	Number of berries gathered
With ADHD	602
Without ADHD	521

Description	Mark allocation
Caption - results representing both variables (C)	1
Table drawn (T)	1
Labels - Rows =independent Column= dependent (L)	1
Data - correct data captured for each independent (D)	2

(5)

3.5.5

Bar✓ graph/ pie chart

(1)

(12)

3.6 3.6.1

Australopithecus✓ afarensis✓

(2)

3.6.2

Ethiopia✓/Great Rift Valley/East Africa

(1)

3.6.3

Bipedalism✓/ Bipedal

(1)

3.6.4

- Foramen magnum is in a more forward position✓
- S-shaped vertebral column✓
- Short and wide pelvis✓

(3)

3.6.5

Homo erectus✓

(1)

(8)**[50]****TOTAL SECTION B: 100****GRAND TOTAL: 150**



education

**MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA**

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2025

MARKS: 150

TIME: 2½ HOURS

This question paper consists of 17 pages.

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.

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.

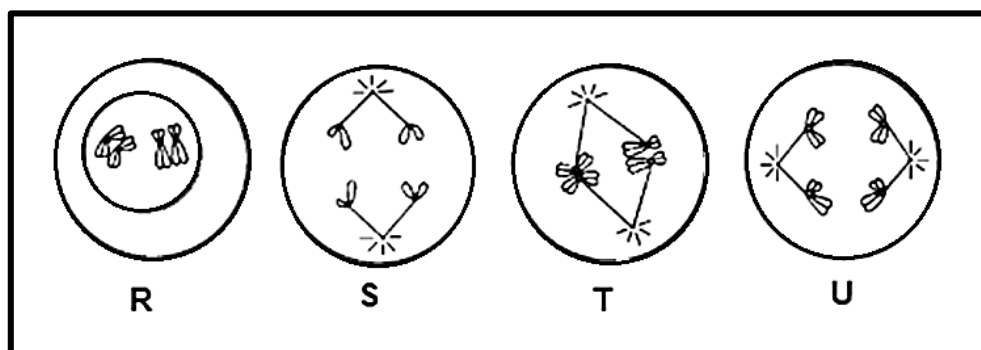
1.1.1 DNA and RNA are examples of...

- A enzymes.
- B nucleic acids.
- C amino acids.
- D proteins.

1.1.2 Which of the following human structures will contain a diploid chromosome number?

- A Gametes
- B Gonosomes
- C Somatic cells
- D Autosomes

1.1.3 Identify the phases that ensures genetic variation among individuals of the same species?



- A R and T
- B S, T and U
- C R, S, T and U
- D R only

1.1.4 Inheritance of multiple alleles in genetics refers to...

- A one allele that influences more than one characteristic.
- B two alleles that influence two characteristics.
- C more than two alleles that influence two characteristics.
- D more than two alleles that influence one characteristic.

- 1.1.5 When two plants, one heterozygous for a characteristic and the other homozygous recessive are crossed, the expected ratio is:
- A 3: 1
 - B 1: 3
 - C 1: 1
 - D 1: 2
- 1.1.6 For a particular characteristic, the offspring inherits ...
- A both alleles from the mother.
 - B one allele from the mother and one allele from the father.
 - C the alleles from either the mother or the father randomly.
 - D both alleles from the father.
- 1.1.7 Limbs of different species show similar structure but has different functions.
- A Comparative embryology
 - B Modification by descent
 - C Biogeography
 - D Genetics
- 1.1.8 Organisms with similar characteristics that are able to interbreed and produce fertile offspring.
- A Population
 - B Community
 - C Family
 - D Species
- 1.1.9 What is the type of variation where characteristics falls into distinct categories?
- A Continuous
 - B Discontinuous
 - C Height
 - D Intelligence
- 1.1.10 Which of the following laws is used to explain Lamarckism?
- A Survival of the fittest
 - B Inheritance of alleles
 - C Use and disuse
 - D Gradualism

(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 sugar molecule presents in a nucleotide of RNA
- 1.2.2 The bond that forms between amino acids in a protein molecule
- 1.2.3 The phase during which single chromosome strands become replicated chromosomes
- 1.2.4 Splitting of cytoplasm during telophase of meiosis
- 1.2.5 A sex-linked disorder that affects the photoreceptors in the eye
- 1.2.6 A cross between a white fowl and a black fowl produce a white and black speckled chicken
- 1.2.7 An organism's entire hereditary information, encoded either in DNA or RNA
- 1.2.8 Type of evolutionary evidence that focusses on tools, jewellery and rituals that gives insight into how early humans lived
- 1.2.9 A network of caves in South Africa where most human fossils has been found
- 1.1.10 Having a long jaw that gives the face a sloped appearance (10 x 1) **(10)**

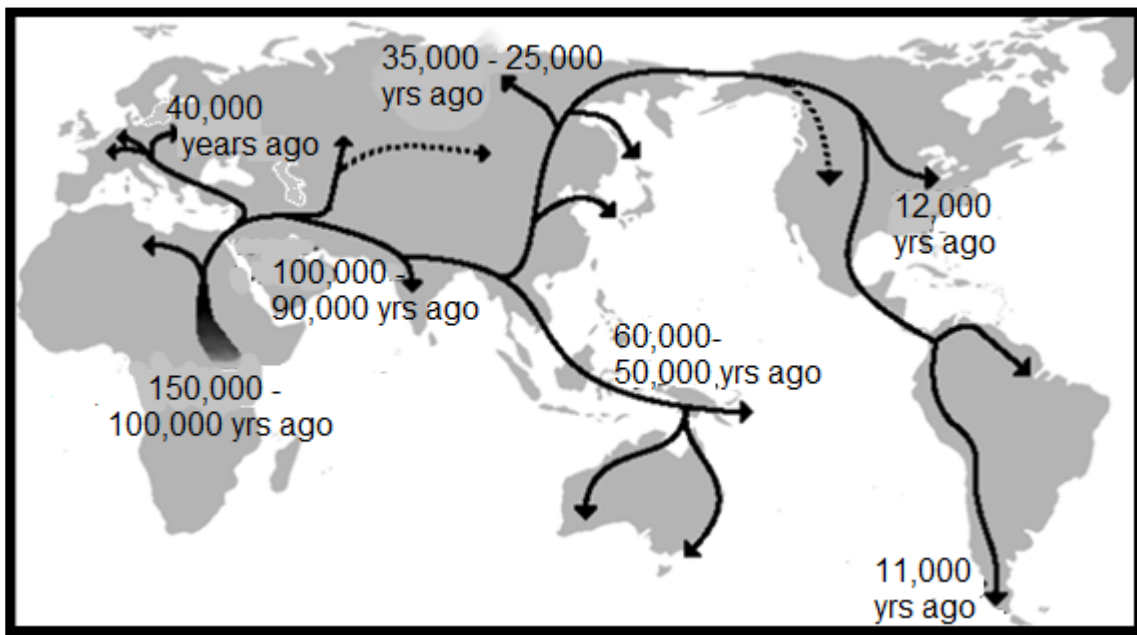
1.3 Indicate whether each of the statements in COLUMN I apply to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 Location of extra nuclear DNA in plant cells only	A: Mitochondria B: Nucleus
1.3.2 Mutation can occur in:	A: Gametes B: Somatic cells
1.3.3 During natural selection the surviving organisms have:	A: Favourable characteristics B: Desirable characteristics

(3 x 2)

(6)

1.4 The map below shows the possible migration patterns of humans across the world.



- | | | |
|-------|---|------------|
| 1.4.1 | Identify the theory represented by the map above. | (1) |
| 1.4.2 | Where did human life begin according to this map? | (1) |
| 1.4.3 | Who were the first species to migrate from the point of origin? | (1) |
| 1.4.4 | How long ago did humans appear in Europe? | (1) |
| 1.4.5 | Which continent was the most recent to be occupied by humans? | (1) |
| 1.4.6 | Which genera never migrated to other continents? | (2) |
| | | (7) |

- 1.5 In a certain type of pigeon, the allele for red eye colour (**R**) is dominant over the allele for black eye colour (**r**), and the allele for grey feathers (**G**) is dominant over allele for white feathers (**g**).

A heterozygous red-eyed pigeon with white feathers is crossed with a black-eyed, heterozygous grey feather pigeon.

1.5.1 State the genotype of the parents. (4)

1.5.2 Give:

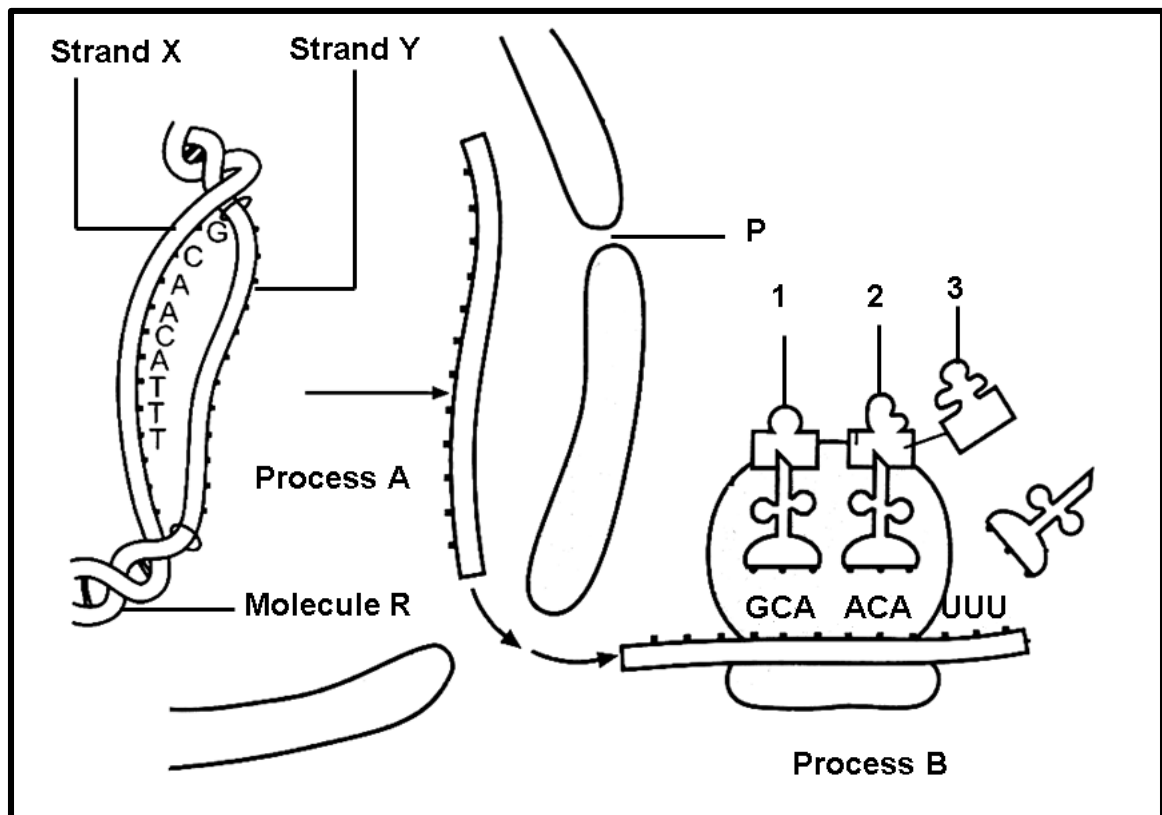
(a) The recessive characteristic of EACH gene. (2)

(b) ALL the possible genotypes of the gametes produced by a pigeon with black eye colour and grey feathers. (1)
(7)

TOTAL SECTION A: 50

SECTION B**QUESTION 2**

2.1 The diagram below represents two stages of protein synthesis. (The sequence of the nitrogenous bases in strand **X** is read from the top to the bottom)



- 2.1.1 State the function of structure **P** during process **A**. (1)
- 2.1.2 Strand **Y** acts as a template during process **A**.
Describe what is meant by a template. (1)
- 2.1.3 Give the sequence of the first base triplets on strand **Y**. (1)
- 2.1.4 Describe TWO differences between the process at **A** and **B**. (4)

- 2.1.5 The table below shows some tRNA anticodons with their corresponding amino acids.

tRNA anticodons	Amino acid
AAA	Phenylalanine
ACA	Threonine
CCA	Glycine
CGU	Alanine
UCU	Cysteine
GCA	Arginine
UGU	Cysteine

Use the table below to determine which amino acids are attached to tRNA molecules.

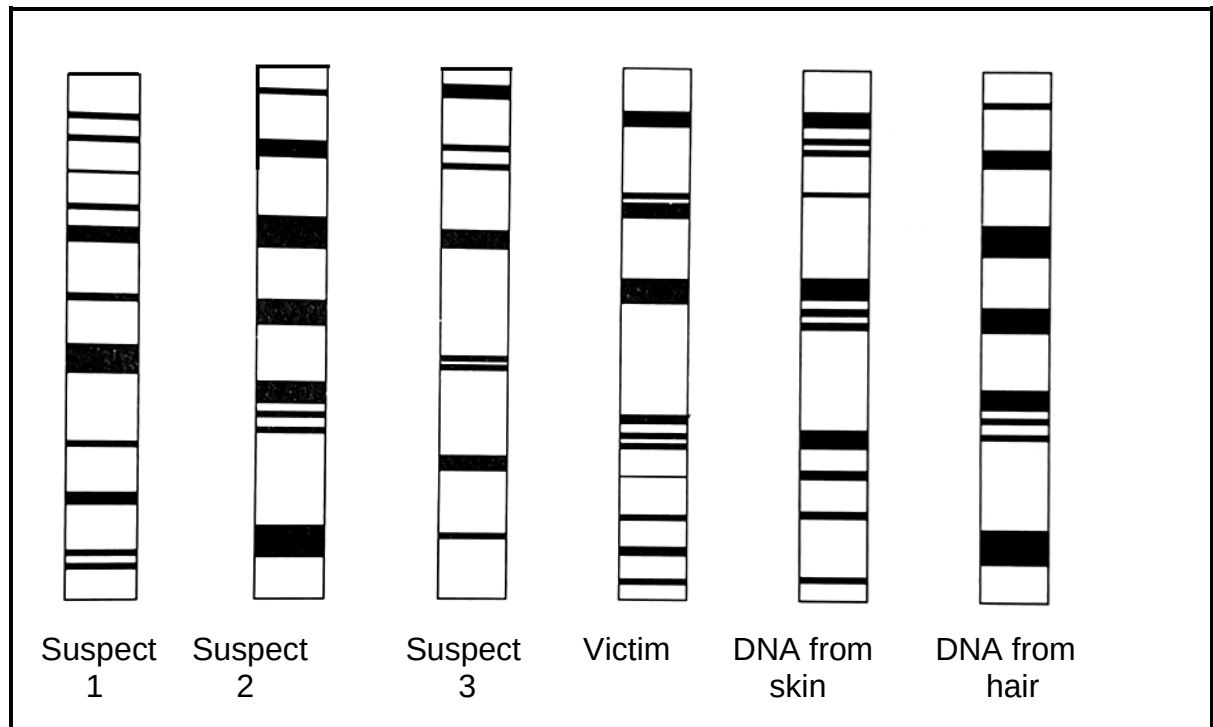
(a) **1** (1)

(b) **3** (1)

- 2.1.6 A mutation caused the second base triplets on strand **Y** to change from **TGT** to **TCT**.

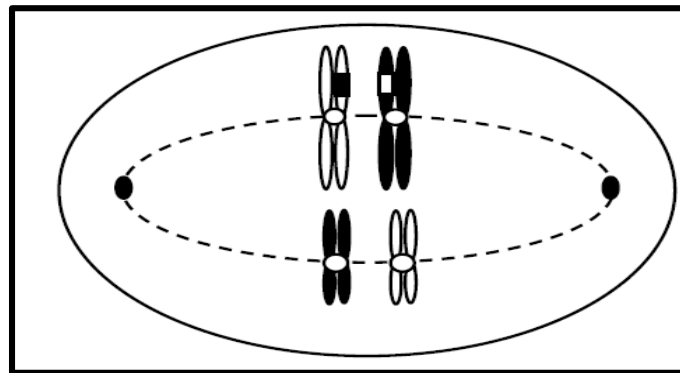
Explain what effect this mutation has on the protein formed. (4)
(13)

- 2.2 An old woman was robbed, stabbed and left to die. Samples of blood were taken from the three suspects, crime scene and the victim to compare their DNA.



- 2.2.1 Identify the technique used. (1)
- 2.2.2 Which of the three suspects was present in the crime scene? (1)
- 2.2.3 Explain your answer to QUESTION 2.2.2. (2)
- 2.2.4 Explain why it cannot be concluded that the DNA from the hair and the skin of the victim were from the same person. (2)
- 2.2.5 Give TWO other uses for this technique. (2)
- (8)**

2.3 The diagram represents a cell undergoing meiosis.

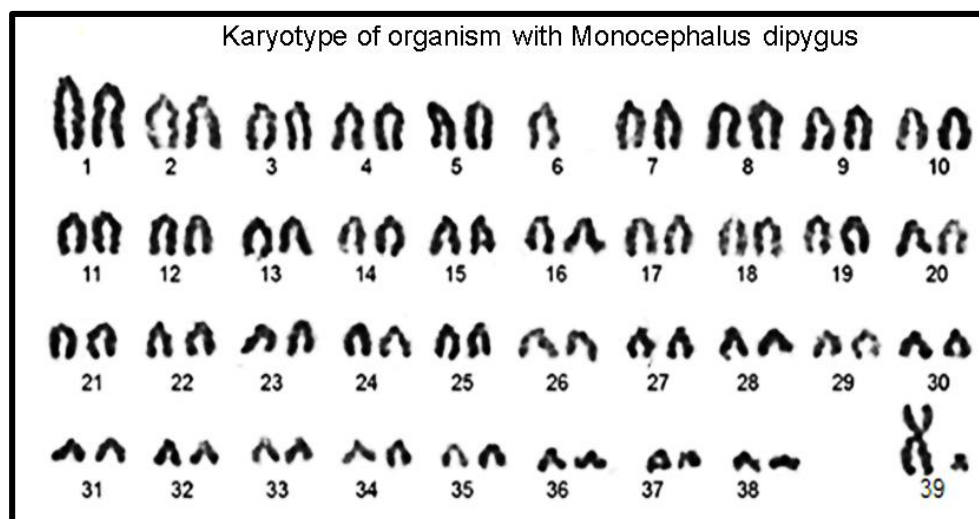


2.3.1 Identify the phase represented in the diagram above. (1)

2.3.2 Describe how the events taking place in the phase following the phase identified in QUESTION 2.3.1 differs during meiosis I and meiosis II. (2)

2.3.3 Draw a fully labelled diagram to represent ONE of the resulting cells at the same phase during meiosis II as represented in the diagram above. (4)
(7)

2.4 Monocephalus dipygus is a condition caused by a mutation. It results in the organism having duplicated organs, extra limbs and extra toes on their limbs.



2.4.1 Identify the gender of this organism. (1)

2.4.2 Does this karyotype belong to a *Homo sapien*? (1)

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

2.4.4 Name and describe the mutation as displayed in the karyotype above. (4)
(8)

- 2.5 Scientists investigated the use of stem cells to repair damaged hearts. The stem cells were injected into the ventricle's muscle tissue.
- 2.5.1 Name ONE source of stem cells. (1)
- 2.5.2 Explain why stem cells were used to repair the damaged heart. (3)
- 2.5.3 Explain why using stem cells from the same person is better than using stem cells from a donor. (2)
- (6)
- 2.6 A man with blood group **AB** and a woman who is heterozygous for blood group **B** plan to have children.
- 2.6.1 How many alleles for blood group does an individual inherit? (1)
- 2.6.2 Explain why group **AB** is an example of co-dominance. (2)
- 2.6.3 Explain how it is possible for a man with blood **AB** and a woman with blood group **B** to have a child with blood group **A**. (5)
- (8)
- [50]

QUESTION 3

3.1 Machado-Joseph is a rare genetic condition that affects the nervous system. This condition is caused by an autosomal dominant allele and results in lack of control of motor-coordination, reflexes and eye movements. Symptoms of this condition are only visible after the age of 40.

3.1.1 Describe what is meant by an autosomal dominant allele. (2)

3.1.2 Suggest why the late development of the symptoms makes it difficult to reduce the number of people born with this condition? (2)

3.1.3 A man who is heterozygous for this condition has a child with a woman who is homozygous recessive.

Use a genetic cross to show the percentage chance of having a child with Machado-Joseph condition.

Use the letter **D** for the dominant allele and **d** for the recessive allele. (6)
(10)

3.2 Read the passage below.

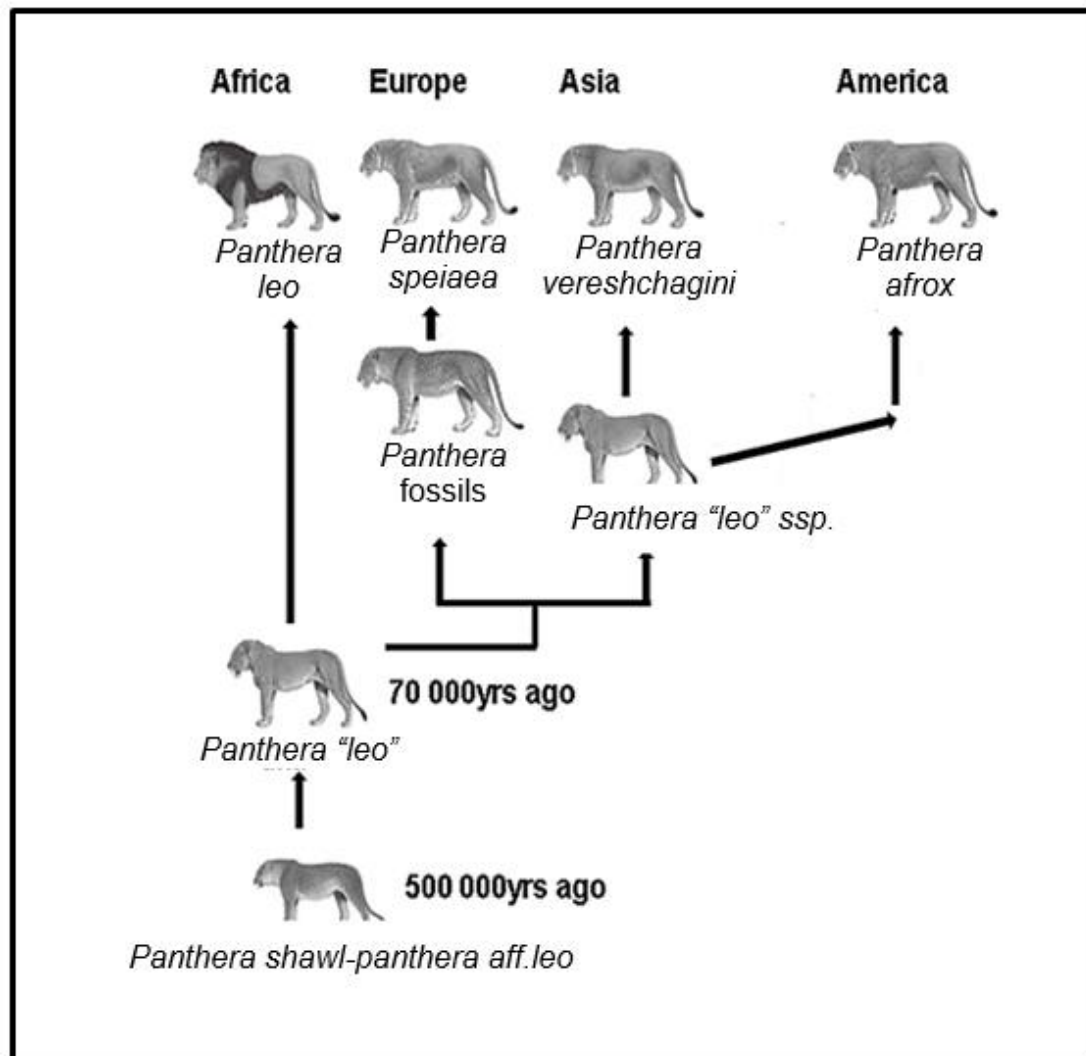
Scientists created genetically modified (GM) adult male mosquitoes. The GM mosquitoes carried a gene from bacteria. The gene causes the death of offspring before they become adults/sexually mature. Since one male mate with many females, this allele is carried to many eggs. Anopheles mosquitoes causing malaria die out without the use of insecticide. As a result, scientists are considering releasing millions of adult male GM mosquitoes into the wild which might help in the fight against malaria.

3.2.1 Describe how the scientists produced the genetically modified adult male mosquitoes. (3)

3.2.2 Suggest ONE advantage of creating the GM adult male mosquitoes. (1)

3.2.3 Describe ONE way in which the process of cloning is different from genetic engineering. (2)
(6)

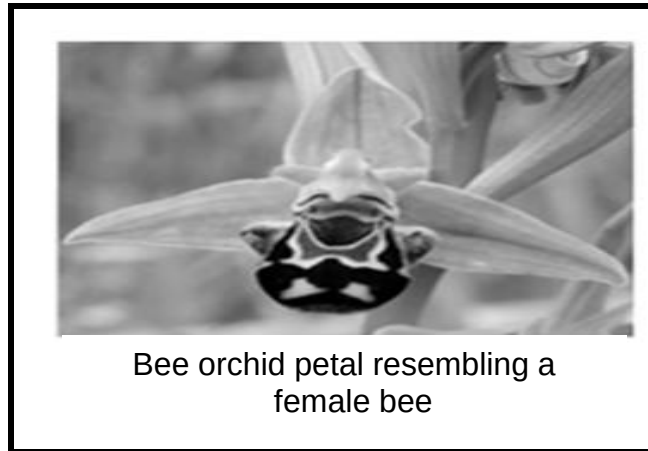
- 3.3 Scientists have conducted studies into the DNA of lions to reveal the evolutionary history of living and extinct lion species. The study concluded that extinct and modern lions shared an ancestor some 500 000 years ago and that the main lineages of modern lions diverged some 70 000 years ago.



- 3.3.1 Name the super continent the common ancestors *Panthera shawl* and *Panthera leo* lived on. (1)
- 3.3.2 Explain the formation of all modern lion species from the common ancestor *Panthera "leo"*. (7)

(8)

- 3.4 Orchid flowers are full of tricks to attract insects. Some resemble the shape and even pheromone smell of a female insect to attract the male insects. When they try to mate with this “female” they get covered in pollen.



- 3.4.1 Identify the reproductive isolating mechanism used by this orchid above. (1)
- 3.4.2 State TWO other reproductive isolating mechanisms used by organisms to ensure successful reproduction. (2)
- 3.4.3 Orchids sometimes needs to evolve quickly to match evolution of the insects they want to attract to make sure their “tricks” are efficient.
- Which evolutionary theory best describes this phenomenon? (1)
- 3.4.4 Describe the theory named in QUESTION 3.4.3 (2)
- (6)

- 3.5 Attention deficit hyperactivity disorder (ADHD) may have evolved in hunter-gatherer societies because it was advantageous for foragers (people gathering plant material for food). Traits that are commonly associated with the condition, such as impulsivity, might have encouraged some foragers to move on from areas with decreasing resources to areas with more resources sooner than those without the condition.

- 506 people were recruited to play an online foraging game. 43% of participants had ADHD symptoms.
- The players were instructed to collect as many berries as they could in 8 minutes by hovering their mouse cursor over bushes.
- They were given the choice to either stay at a bush or to try their luck by leaving for another, which may have more or fewer berries. Moving to a new bush caused them to lose time, so the players had to balance the benefits of potentially getting more berries with the time lost due to moving on.
- Those with ADHD symptoms spent about 4 seconds less hovering over any given bush compared with those without signs of the condition, which resulted in the ADHD group collecting an average of 602 berries compared with 521.

- 3.5.1 Design an investigative question for this simulation. (2)
- 3.5.2 Name TWO planning steps with regards to the participants for this investigation. (2)
- 3.5.3 Calculate the number of participants showing ADHD symptoms. (2)
- 3.5.4 Draw a table to record the results obtained. (5)
- 3.5.5 Identify the type of graph best suited to represent the given data. (1)
- (12)**

3.6 November 2024 marked the 50-year anniversary of the discovery of the fossil known as Lucy. She was about three-million-years old with a small body and brain but were able to walk upright. They also found that she had wisdom teeth in her jaw which meant she was an adult despite her small size.

3.6.1 To which specie does Lucy belong? (2)

3.6.2 In which region was Lucy found? (1)

3.6.3 What is the term used for the ability to walk upright? (1)

3.6.4 Lucy was the most complete fossilized skeleton found at that time. List THREE features you would expect to find in her skeleton causing scientist to conclude that she walked upright. (3)

3.6.5 After Lucy there were many more species found with the ability to walk upright. Give the scientific name of the species that directly translates to "upright man". (1)
(8)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150



education

Department of
Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2025

MARKS: 150

TIME: 2½ HOURS

This question paper consists of 18 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 for each question.
6. ALL drawings should 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, a 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 to 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 characteristics applies to bipedal organisms?

- A A more backwards position of the foramen magnum
- B A short and wide pelvis
- C A long and narrow pelvis
- D A C-shaped spine

1.1.2 Which of the following shows the process of DNA replication in the correct sequence?

- A Double helix DNA structure unwinds → double strands unzip → complementary nucleotides pair up → two DNA strands are formed.
- B Double helix DNA structure unwinds → double strands unzip → complementary nucleotides pair up → two DNA molecules are formed.
- C Double helix DNA structure unzips → double strands unwind → complementary nucleotides pair up → two DNA molecules are formed.
- D Double helix DNA structure unwinds → double strands unzip → one strand serves as a template → complementary nucleotides pair up → two DNA molecules are formed.

1.1.3 A trait that has a range of intermediate phenotypes is an example of ...

- A continuous variation.
- B co-dominance.
- C discontinuous variation.
- D complete dominance.

1.1.4 Which ONE of the following is the possible genotypes of the parents (P_1) that will result in a genotype ratio of 1:1 in the F_1 generation?

- A BB x BB
- B Bb x bb
- C bb x bb
- D Bb x Bb

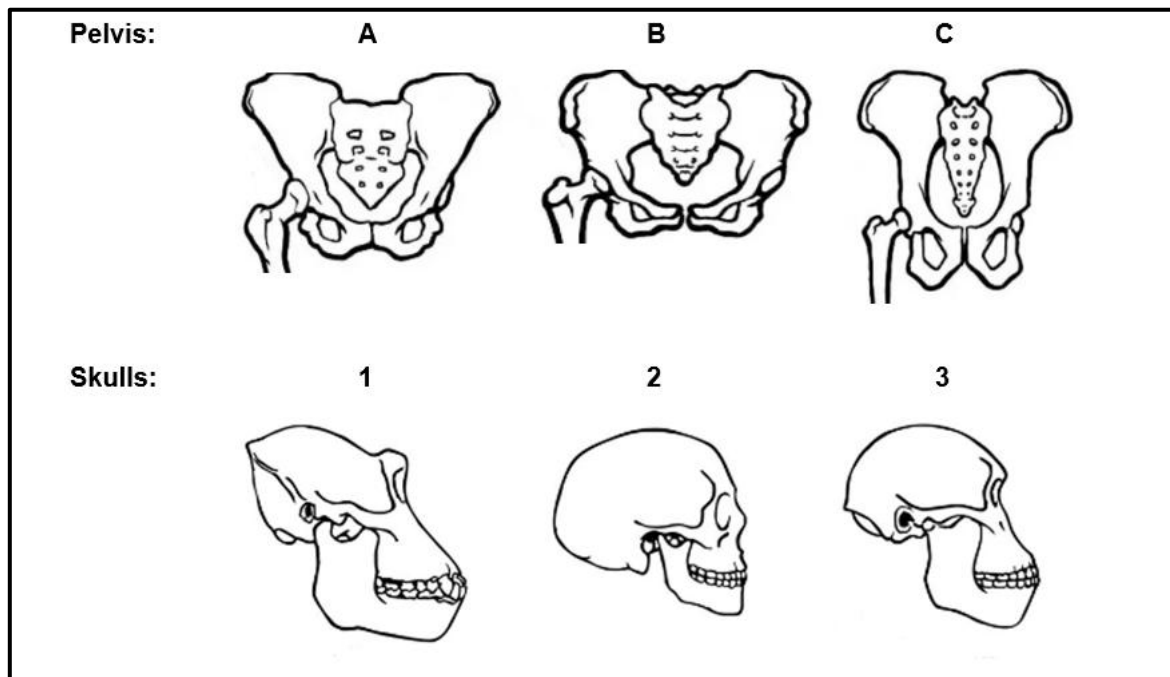
1.1.5 The following statements are sources of variation.

- (i) Random fertilisation
- (ii) Crossing over
- (iii) Random assortment of chromosomes in Metaphase 1
- (iv) Mutation

Which ONE of the following combinations is a source of phenotypal variation?

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

1.1.6 The diagrams below represent the pelvises and skulls of Hominids.



The correct combination of pelvises and skulls is:

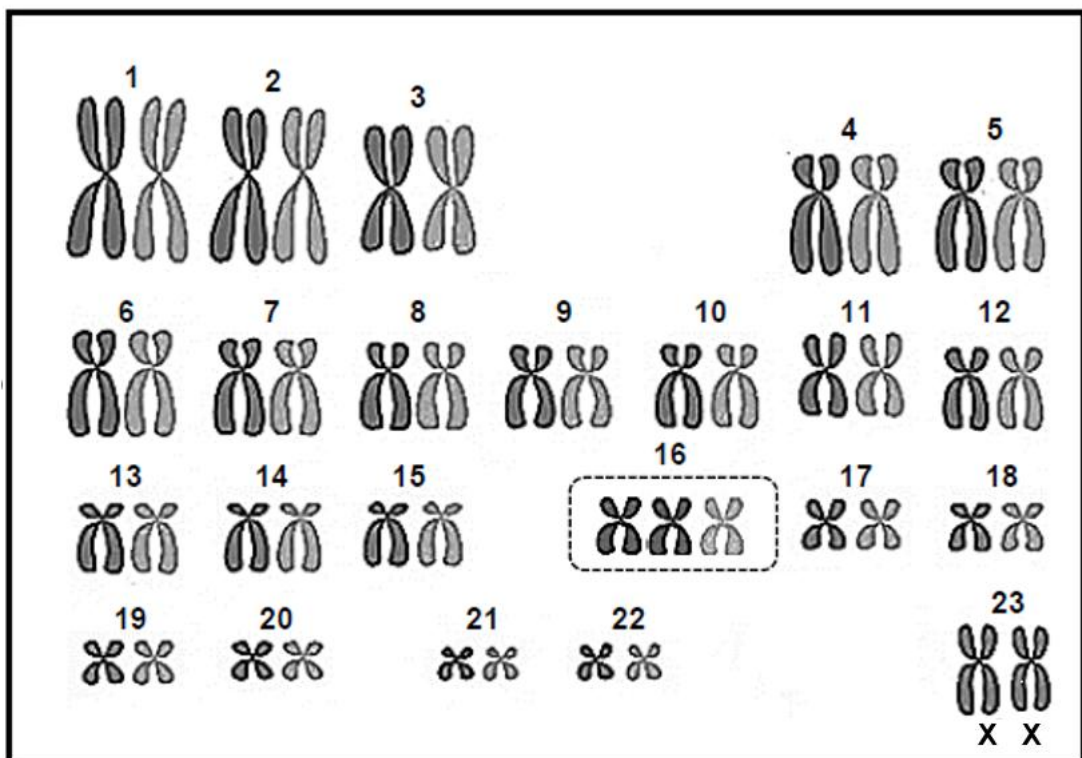
	PELVIS A	PELVIS B	PELVIS C
A	Skull 1	Skull 2	Skull 3
B	Skull 1	Skull 3	Skull 2
C	Skull 3	Skull 2	Skull 1
D	Skull 2	Skull 3	Skull 1

1.1.7 Which ONE of the following statements relates to Lamarck's theory of evolution?

- A The allele for a favourable characteristic is inherited.
- B An acquired characteristic is inherited.
- C A larger proportion of the next generation will have the favourable characteristic.
- D Long periods of no change are followed by short periods of sudden change.

QUESTION 1.1.8 TO 1.1.9 REFER TO THE KARYOTYPE BELOW.

The karyotype below represents the chromosomes present in a human somatic cell.



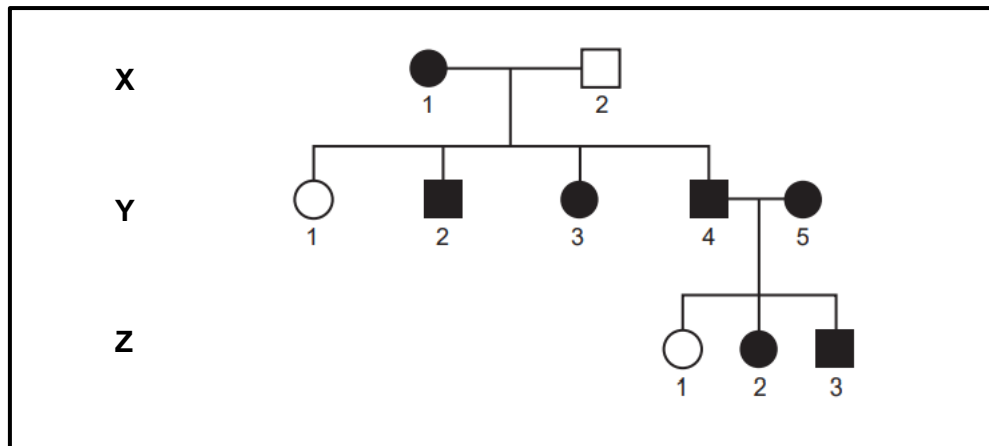
1.1.8 The chromosomal composition of this cell is ...

- A 44 autosomes and 2 gonosomes.
- B 47 chromosomes.
- C 45 autosomes and 2 gonosomes.
- D 46 chromosomes.

1.1.9 How many ova would carry the X chromosome if meiosis occurred in the above cell?

- A 1
- B 2
- C 3
- D 4

- 1.1.10 Familial atrial fibrillation is a condition in which individuals have an altered heart rhythm. Familial atrial fibrillation is an inherited condition that follows an autosomal dominant inheritance pattern. Shaded individuals in the following pedigree have this condition.



By studying the pedigree diagram, it could be concluded that in ...

- A generation **X**, individual **1** is homozygous.
- B generation **Y**, individual **1** is heterozygous.
- C generation **Y**, individual **3** is heterozygous.
- D generation **Z**, individual **1** is heterozygous.

(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 1.2.10) in the ANSWER BOOK.

1.2.1 Genetic disorders are controlled by recessive alleles that are found on the gonosomes

1.2.2 A testable statement that can be supported by scientific evidence

1.2.3 A genetic cross involving only one characteristic

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

1.2.5 The dominance where the heterozygous phenotype is an intermediate between the two dominant homozygous phenotypes

1.2.6 The phase during meiosis nuclear when membranes will reappear in two daughter cells

1.2.7 A change in an organism's nucleotide sequence of the DNA molecule

1.2.8 The genetic condition is characterised by the absence of a blood clotting factor in humans

1.2.9 The study of the geographical distribution of species – providing evidence for evolution

1.2.10 The theory of evolution proposes that the offspring will inherit the alleles for favourable characteristics

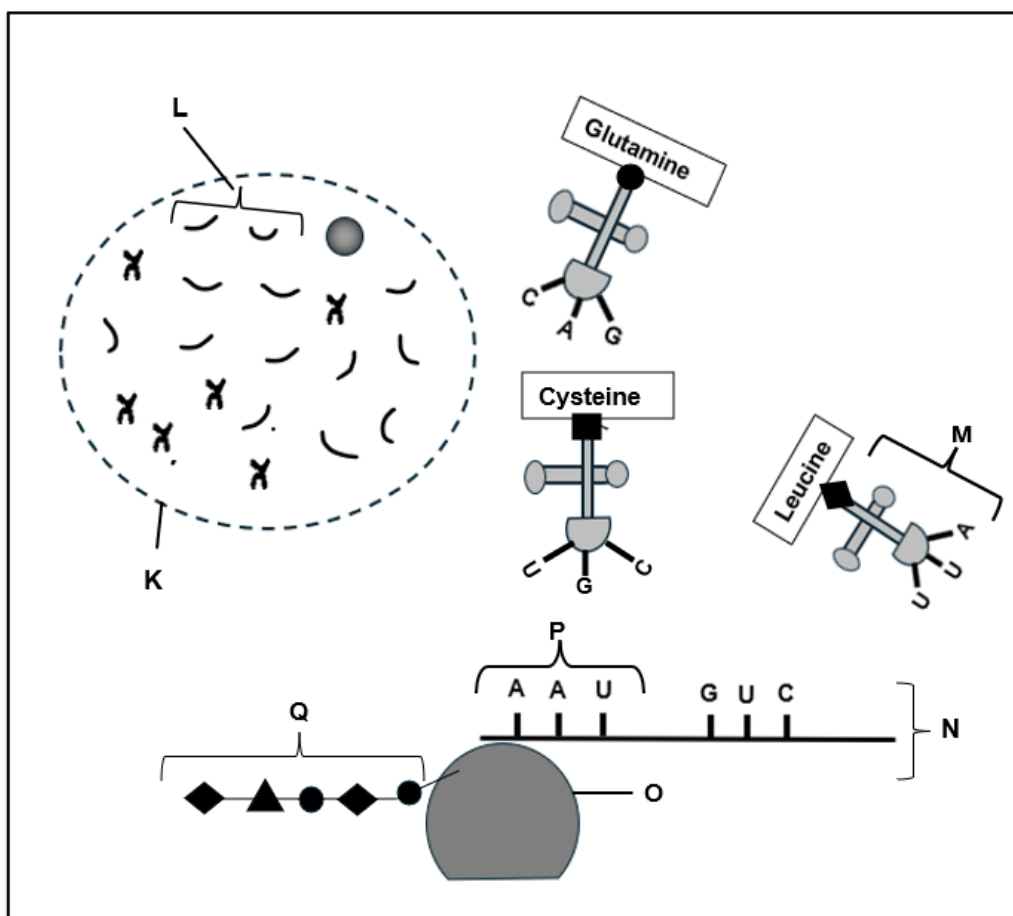
(10)

- 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	Cultural evidence to support human evolution	A: Art B: Tools
1.3.2	Stem cells	A: Undifferentiated somatic cells B: Differentiated somatic cells
1.3.3	Multiple alleles	A: Blood groups B: Haemophilia

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

1.4 The diagram below is a representation of protein synthesis.



1.4.1 Identify:

- Structure **K** (1)
- Molecule **Q** (1)

1.4.2 Give the LETTER of the:

- Organelle where translation took place (1)
- Tangled network of DNA (1)
- Hair-pin-shaped nucleic acid (1)

1.4.3 Determine the complementary DNA base triplet for codon **P**. (2)

1.4.4 Name of the amino acids, from left to right, as they will bind on molecule **N**. (2)

[9]

- 1.5 Complete the following table representing famous scientists, the hominin fossils they discovered, and the fossil site where these discoveries were made.

Write only the answer next to the question numbers (1.5.1 to 1.5.5) in the ANSWER BOOK.

SCIENTISTS RESPONSIBLE FOR THE DISCOVERY	COMMON NAME OF FOSSIL	SPECIE NAME	FOSSIL SITE
1.5.1	Mrs Ples	1.5.2	Sterkfontein caves
Raymond Dart	1.5.3	<i>Australopithecus africanus</i>	Taung, North West
1.5.4	Karabo	1.5.5	Malapa caves

(5)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

Read the extract below.

2.1 On 26 December 2004, a powerful undersea earthquake triggered a devastating tsunami, claiming the lives of at least 225 000 people across multiple countries.

Due to the overwhelming number of casualties and severe damage to infrastructure, mass graves became necessary to bury the bodies.

DNA profiling was used to identify some of the victims, months after these bodies were buried. DNA samples were taken from the bodies before burial to compile DNA profiles. DNA profiles were then also compiled from samples provided by family members. These samples were collected from toothbrushes, hairbrushes or clothing of the deceased. This process helped identify some of the victims.

2.1.1 What tissue can be collected from a toothbrush to use as a source of DNA? (1)

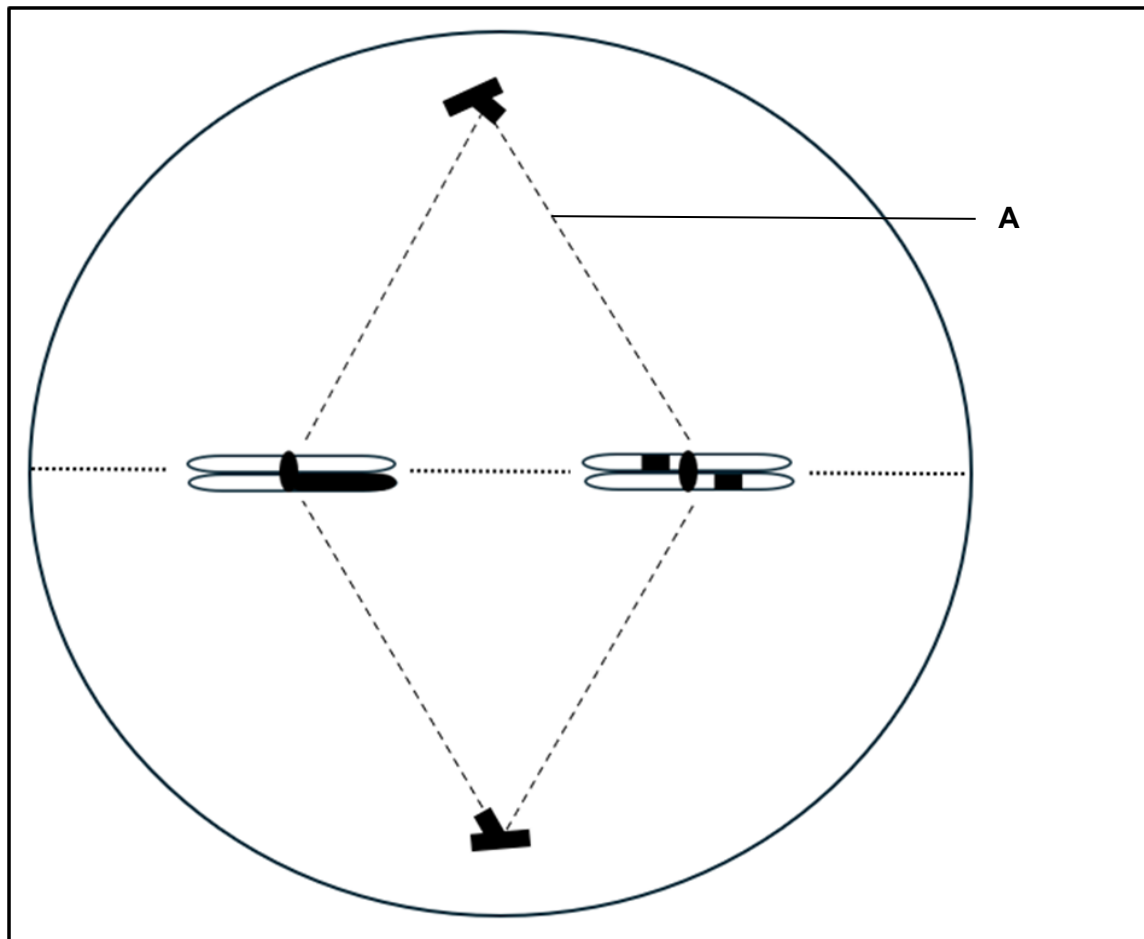
2.1.2 Explain how DNA profiling was used to identify some of the tsunami victims. (4)

2.1.3 In some cases, no personal effects of the victims could be found. Which family member (the **VICTIM'S SPOUSE** or the **VICTIM'S PARENTS**) could be used to provide a DNA sample for comparison? (1)

2.1.4 Explain your answer to QUESTION 2.1.3. (3)

2.1.5 Describe the structure of a DNA molecule. (6)
(15)

2.2 The diagram below represents a phase of meiosis in the testes.



2.2.1 Identify the phase represented in the diagram. (1)

2.2.2 State ONE function of **A**. (2)

2.2.3 In this phase, give the number of:

a) Centrioles. (1)

b) Chromosomes present at the beginning of meiosis in this cell. (1)

c) Gametes that will form at the end of meiosis. (1)

2.2.4 Describe the behaviour of the chromosomes during the phase in the above diagram. (3)

2.2.5 Explain Mendel's law of segregation during meiosis. (3)
(12)

- 2.3 Henry VIII was king of England from 1509 to 1547. During his reign, he had six wives. Infamously, he sent two of his wives, Anne Boleyn and Catherine Howard, to their deaths on the executioner's block at the Tower of London. One of the reasons he had these wives executed was the fact that they had not given birth to a male heir.

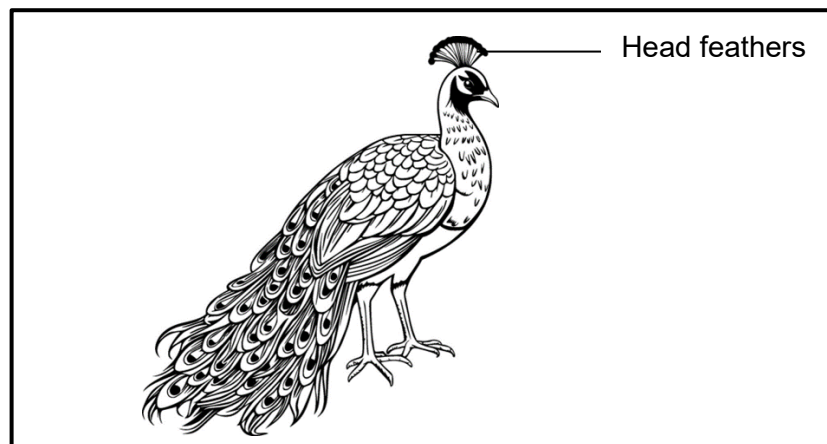
2.3.1 Which parent determines the sex of a child? (1)

2.3.2 Draw a labelled diagram to illustrate the structure of the gonosomes in a male somatic cell. (3)

2.3.3 Explain why Henry VIII, and not his wives, was responsible for the sex of his children. (4)
(8)

- 2.4 In all birds, the sex chromosomes of males are of equal length and are referred to as the ZZ chromosomes. Female birds have sex chromosomes of unequal length that are referred to as the ZW chromosomes.

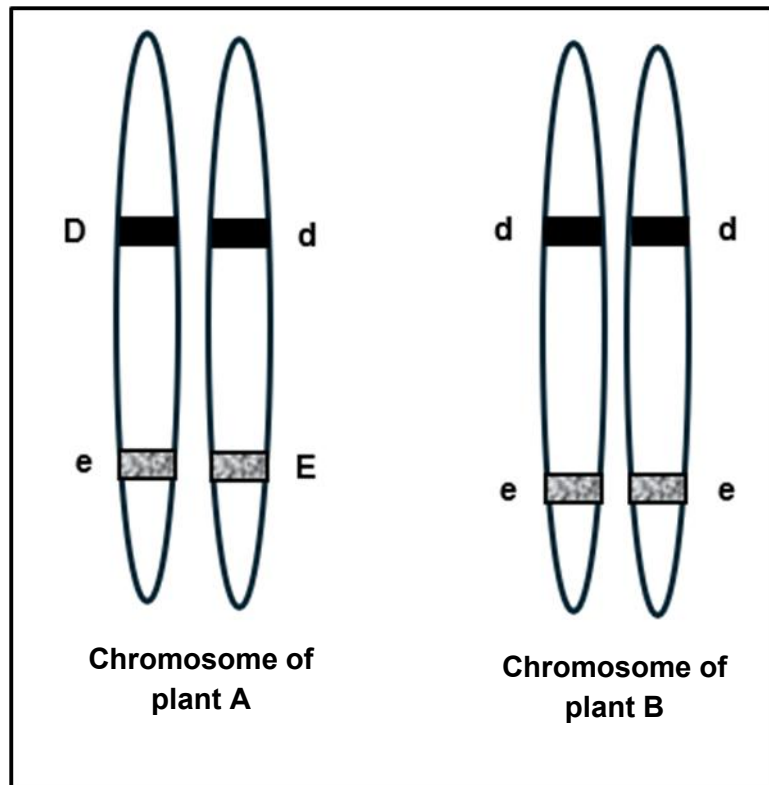
The inheritance of head feathers is sex-linked, and the gene for head feather colour in a bird is only found on the Z chromosome. The W chromosome does not contain a copy of this gene. Red head feathers (**R**) are dominant over black head feathers (**r**).



Using the letters **R** and **r**, do a genetic cross between a heterozygous male with red head feathers and a female with black head feathers to show the phenotype ratio of the offspring. (6)

- 2.5 In a certain type of plant, the genes that determine the leaf shape and the colour of the flowers are found on the same chromosome. The leaf could either be wrinkled (**D**) or smooth (**d**), and the flowers could either be purple (**E**) or red (**e**).

The diagram below represents the arrangement of alleles on the chromosomes in plants **A** and **B**.



- 2.5.1 Identify the:
- Phenotype of plant **A**. (2)
 - Genotype of plant **B**. (2)
 - Plant that has a chromosome with homozygous alleles. (2)
- 2.5.2 Determine how many possible different genotypes the gametes of plant **A** can have. (1)
- 2.5.3 Plants **A** and **B** are crossed with each other. What percentage of the offspring will have wrinkled leaves and purple flowers? (2)
(9)
[50]

QUESTION 3

3.1

The Bucardo (*Capra pyrenaica pyrenaica*) was a large, wild goat with long, curved horns. For centuries, it lived high in the mountain range that divides France from Spain.



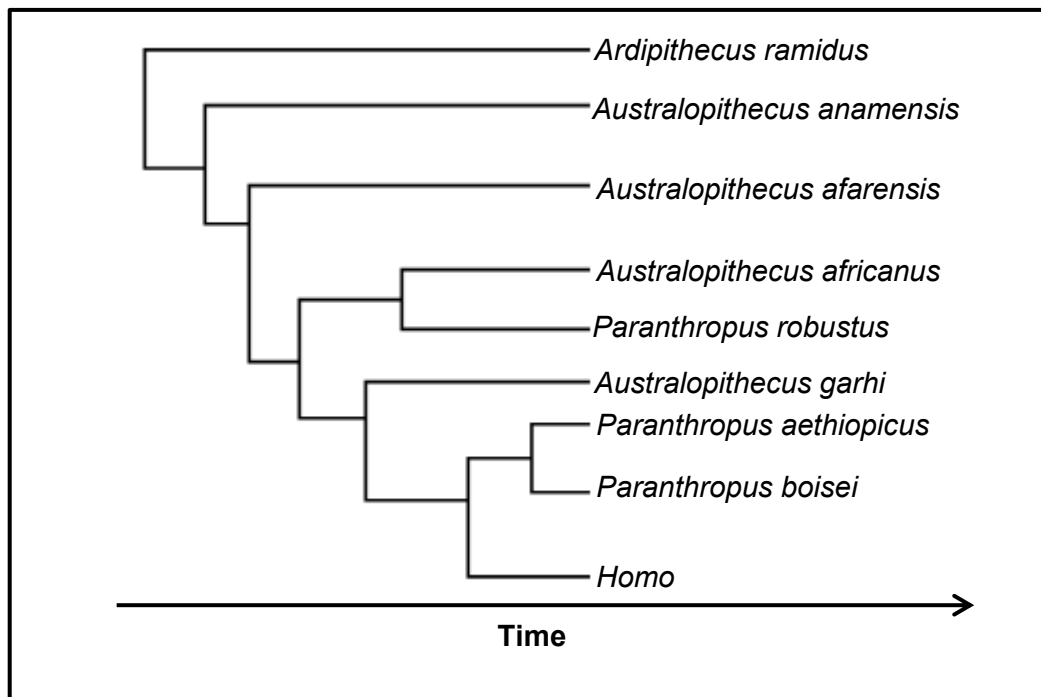
(*Capra pyrenaica pyrenaica*)

They were once abundant, but extensive hunting reduced their numbers to only a hundred individuals in 1899. The last bucardo, known as Celia, was found dead in January 2000 by park rangers. Dr Jose Folch, from Spain, had, however, captured Celia the previous year and had taken a tissue sample from her ear.

Using the same techniques used to clone Dolly the sheep, researchers could transplant DNA from the ear tissue into ova taken from domestic goats to create 439 embryos, of which 57 were implanted into surrogate ewes (females). Only seven of the embryos resulted in pregnancies.

- 3.1.1 Name the biotechnology process used to make an identical copy of the Bucardo. (1)
- 3.1.2 Why was a tissue sample from Celia's ear used? (2)
- 3.1.3 Explain the procedure used to create an exact copy of the Bucardo using the tissue sample obtained from the ear. (6)
- 3.1.4 Describe how the researchers could have calculated the percentage success rate of implanted embryos that resulted in pregnancy. (3)
- (12)**

- 3.2 The diagram below shows the possible relationships between different hominids.



- 3.2.1 Identify the type of diagram shown above. (1)
- 3.2.2 How many genera are represented in this diagram? (1)
- 3.2.3 Name the species:
- a) That is the oldest. (1)
- b) That shares the most recent common ancestor with *Australopithecus africanus*. (1)
- 3.2.4 Name TWO forms of evidence that could have been used to support the information in the above diagram. (2)
- 3.2.5 Give the name of the *Homo* species that used weapons and tools for the first time. (1)
- 3.2.6 Describe how the discovery of *Homo* fossils supports the 'Out of Africa' theory. (3)
- 3.2.7 Explain the significance of THREE changes to the human skull that show progression in evolution. (6)
- (16)**

3.3 Read the extract below.

Scientists investigated, determining which type of inheritance accounted for genetic disorders in Dobermans. All dogs have a chromosome count of 78.

The procedure they used was as follows:

- They sequenced the genomes of 1200 dogs of the same breed (Dobermans).
- All the Dobermans suffered from various genetic disorders.
- To ensure that all the desired characteristics are present in Dobermans, breeders use the process of artificial selection.
- They drew a sample of 5 millilitres of blood from each dog to collect the necessary genetic information.



The result of the investigation is represented in the following table:

Percentage of different types of inheritance of genetic disorders in Doberman dogs.	
Type of inheritance of genetic disorder	Percentage of Dobermans affected by type of inheritance
Autosomal dominant	71%
Autosomal recessive	11%
Sex-linked	10%
Other	8%

3.3.1 Identify the independent variable. (1)

3.3.2 State TWO ways in which the scientists ensured the validity of the investigation. (2)

3.3.3 Explain why there is no need to keep the Dobermans' age constant in this type of investigation. (2)

3.3.4 Explain why the inheritance of an autosomal dominant disorder is so much higher than the inheritance of a sex-linked disorder. (3)

3.3.5 Draw a pie graph to represent the information provided in the table. (6)
(14)

3.4 Read the extract below.

Scientists have discovered that an extinct grey wolf species had the gene to produce amylase and digest starch, and benefited from the human food they were scavenging. Today, domesticated dogs, compared to wolves, produce much more amylase, allowing dogs to benefit from the high-starch diet of humans in a way that wolves never can.

3.4.1 Use the example in the passage and explain how dogs initially may have evolved, through natural selection, from an extinct grey wolf species. (6)

3.4.2 Explain why all breeds of domestic dogs belong to the same species. (2)
(8)
[50]

TOTAL SECTION B: 100
GRAND TOTAL 150



education

Department of
Education
FREE STATE PROVINCE

PREPARATORY EXAMINATION

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2025

MARKS: 150

MARKING GUIDELINES

These marking guidelines consist of 12 pages.

PRINCIPLES RELATED TO MARKING LIFE SCIENCES

1. **If more information than marks allocated is given**
Stop marking when maximum marks are reached and put a wavy line and 'max' in the right-hand margin.
2. **If, for example, three reasons are required and five are given**
Mark the first three irrespective of whether all or some are correct/incorrect.
3. **If the whole process is given when only a part of it is required**
Read all and credit the relevant part.
4. **If comparisons are asked for, but descriptions are given**
Accept if the differences/similarities are clear.
5. **If tabulation is required, but paragraphs are given**
Candidates will lose marks for not tabulating.
6. **If diagrams are given with annotations when descriptions are required**
Candidates will lose marks.
7. **If flow charts are given instead of descriptions**
Candidates will lose marks.
8. **If the sequence is muddled and links do not make sense**
Where sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If the sequence and links become correct again, resume credit.
9. **Non-recognised abbreviations**
Accept if first defined in the answer. If not defined, do not credit the unrecognised abbreviation, but credit the rest of the answer if correct.
10. **Wrong numbering**
If the answer fits into the correct sequence of questions, but the wrong number is given, it is acceptable.
11. **If the language used changes the intended meaning**
Do not accept.
12. **Spelling errors**
If recognisable, accept the answer, provided it does not mean something else in Life Sciences or if it is out of context.
13. **If common names are given in terminology**
Accept, provided it was accepted at the national memo discussion meeting.

14. **If only the letter is asked for, but only the name is given (and vice versa)**
Do not credit.
15. **If units are not given in measurements**
Candidates will lose marks. The memorandum will allocate marks for units separately.
16. **Be sensitive to the sense of an answer, which may be stated differently.**
17. **Caption**
All illustrations (diagrams, graphs, tables, etc.) must have a caption.
18. **Code-switching of official languages (terms and concepts)**
A single word or two that appear(s) in any official language other than the learner's assessment language used to the greatest extent in his/her answers should be credited if it is correct. A marker that is proficient in the relevant official language should be consulted. This applies to all official languages.
19. **Changes to the marking guidelines**
No changes must be made to the memorandum. The provincial internal moderator must be consulted.

SECTION A

QUESTION 1

1.1	1.1.1	B ✓✓	
	1.1.2	B ✓✓	
	1.1.3	A ✓✓	
	1.1.4	B ✓✓	
	1.1.5	A ✓✓	
	1.1.6	C ✓✓	
	1.1.7	B ✓✓	
	1.1.8	C ✓✓	
	1.1.9	A ✓✓	
	1.1.10	C ✓✓	
			(10 x 2) (20)
1.2	1.2.1	Sex-linked ✓	
	1.2.2	Theory ✓	
	1.2.3	Monohybrid ✓ cross	
	1.2.4	Interphase ✓	
	1.2.5	Incomplete ✓	
	1.2.6	Telophase 1 ✓	
	1.2.7	(Gene) Mutation ✓	
	1.2.8	Hemophilia ✓	
	1.2.9	Biogeography ✓	
	1.2.10	Darwinism ✓	
			(10 x 1) (10)
1.3	1.3.1	BOTH A and B ✓✓	
	1.3.2	A ONLY ✓✓	
	1.3.3	A ONLY ✓✓	
			(3 x 2) (6)
1.4	1.4.1	a) Nuclear membrane ✓ / Nucleus	(1)
		b) Polypeptide ✓ / protein	(1)
	1.4.2	a) O ✓	
		b) L ✓	
		c) M ✓	(3)
	1.4.3	TTA ✓✓	(2)
	1.4.4	Leucine, Glutamine (correct order) ✓✓ / Leu, Glu	(2)
			(9)

1.5	1.5.1	(Robert) Broom ✓	(1)
	1.5.2	<i>Australopithecus africanus</i> ✓	(1)
	1.5.3	Taung child ✓ (NOT baby)	(1)
	1.5.4	(Lee) Berger ✓ / Burger	(1)
	1.5.5	<i>Australopithecus sediba</i> ✓	(1)
			(5)

TOTAL SECTION A: 50

SECTION B

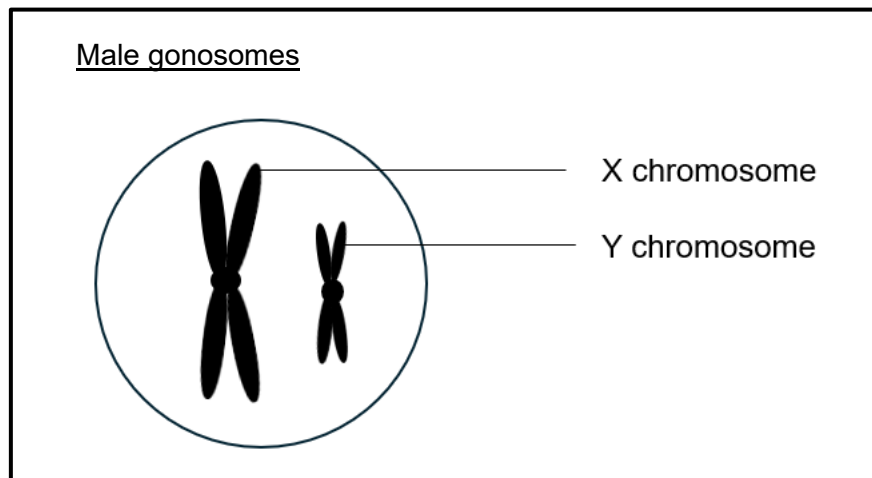
QUESTION 2

- 2.1 2.1.1 (Cheek) epithelial ✓ tissue (1)
- 2.1.2 - DNA- profile bars of victim ✓
- were compared ✓ to
- DNA-profile bars from toothbrush ✓/hairbrush /clothing samples provided by family members
- If ALL the DNA bars /lines /stripes were the same, ✓ the person was identified. (4)
- 2.1.3 (Victim's) parents ✓ (1)
- 2.1.4 - The victim will share NO /FEW DNA bars/stripes /lines with their spouse ✓
- ALL the DNA bars /stripes /lines that do not match their mother ✓ will match their father ✓ (3)
- 2.1.5 - Double stranded ✓
- Helix shaped ✓
- Nucleotides ✓ consist out of deoxyribose, ✓ phosphate ✓ and a nitrogen base ✓/ T, C, G and A
- Nitrogen bases pair in complimentary manner ✓/A pairs with T and G pair with C / T=A; G=C
- Nitrogen bases bind with a hydrogen bond ✓ (any 6) (6)
(15)
- 2.2 2.2.1 Metaphase II (1)
- 2.2.2 It contracts/ shortens ✓ pulling the chromatid ✓/daughter chromosomes toward the (opposite) poles ✓ (any 2) (2)
- 2.2.3 a) 2 ✓ (1)
b) 4 ✓ (1)
c) 4 ✓ (1)
- 2.2.4 - Single ✓/ Individual chromosomes
- from a single row ✓
- on the equator ✓
- spindle fibres attach to the centromeres ✓ (any 3) (3)
- 2.2.5 - An organism possesses two 'factors' ✓
- which separate or segregate ✓ during meiosis
- so that each gamete contains only one of these 'factors' ✓ (3)
(12)

2.3 2.3.1 The father ✓ /male /man

(1)

2.3.2



Criteria	Elaboration	Mark
Heading (H)	Descriptive heading: refers to male gonosomes	1
Diagram (D)	One large X chromosome and one small Y chromosome	1
Labels (L)	Any ONE correct label Chromatid, centromere, X-chromosome, Y- chromosome	1

(3)

- 2.3.3
- Henry's gametes/sperm cells have one X-chromosome or one Y-chromosome ✓
 - Ann and Catherine's gametes/ova have only X-chromosomes ✓
 - If an ovum is fertilised by an X bearing sperm, a female/ girl will form ✓
 - If an ovum is fertilised by a Y bearing sperm, a boy/male is formed ✓

(4)

(8)

2.4 P₁ Phenotype Red feathered male x Black feathered female ✓

Genotype Z^RZ^r x Z^rW ✓

Meiosis

Gametes Z^R/Z^r x Z^r/W ✓

Fertilisation

F₁ Genotype Z^RZ^r Z^RW Z^rZ^r Z^rW ✓

Phenotype Male with red feathers, male with black feathers, female with red feathers, female with black feathers ✓

1:1:1:1 ✓ *

P₁ and F₁ ✓

Meiosis and fertilisation ✓

***1 compulsory mark + any 5**

OR

P₁ Phenotype Red feathered male x Black feathered female ✓

Genotype Z^RZ^r x Z^rW ✓

Meiosis

Gametes	Z ^R	Z ^r
Z ^r	Z ^R Z ^r	Z ^r Z ^r
W	Z ^R W	Z ^r W
1 mark for correct gametes ✓ 1 mark for correct genotypes ✓		

Phenotype Male with red feathers, male with black feathers, female with red feathers, female with black feathers ✓

1:1:1:1 ✓ *

P₁ and F₁ ✓

Meiosis and fertilisation ✓

***1 compulsory mark + any 5 (6)**

[50]

QUESTION 3

- 3.1 3.1.1 Cloning ✓ (1)
- 3.1.2 Desired characteristics ✓ / genes / genetic material
Of somatic cell ✓ / diploid chromosome count / 2n (2)
- 3.1.3 - The diploid nuclei were removed from the ear cell ✓,
- The receiver cells were egg cells/ova from domestic goats ✓
- Nuclei of ova were removed ✓
- The diploid nuclei of the Bucardo /Celia were ✓
- transferred into the ova of the domestic goats ✓
- The ova were stimulated to divide through mitosis ✓
- Zygotes developed into embryos ✓
- Embryos were implanted into surrogate goats ✓ (any 6) (6)
- 3.1.4 They took the 7 embryos that resulted in pregnancies ✓
Divide the number of implanted embryos ✓ / 57
Multiply by 100 ✓
(No marks for a mathematical calculation. The question is DESCRIBE.) (3)
(12)
- 3.2 3.2.1 Phylogenetic tree ✓ /cladogram (1)
- 3.2.2 4 ✓ (1)
- 3.2.3 a) *Ardipithecus ramidus* ✓ (1)
b) *Paranthropus robustus* ✓ (1)
- 3.2.4 - Cultural ✓
- Genetic ✓
- Fossil ✓ (any 2) (2)
- 3.2.5 *Homo habilis* ✓ (1)
- 3.2.6 *Homo habilis* was found in Africa ONLY ✓
OLDEST fossils of *Homo erectus* and *Homo sapiens* found in Africa ✓
YOUNGER *Homo* fossils found in other parts of the world ✓ (3)
- 3.2.7 - More forward position of the foramen magnum ✓ – develop ability to walk on two feet ✓ /bipedalism
- Larger cranium ✓ /more rounded cranium – increase in brain size ✓ /more intelligent

- Flatter face ✓/less sloping forehead /non-prognathous /more develop chin / smaller canines / no diastema / prominent brow ridge – due to softer food ✓/smaller muscles for chewing
 - Well developed chin ✓ - development of speech ✓
 - S-shaped spine ✓ - absorb shock ✓when walking on two legs
 - Pelvis is short and wide ✓ - to carry the weight ✓ of the upper body when walking on two legs
- (6)

3.3 3.3.1 Type of inheritance ✓ (1)

3.3.2 Same breed of dog ✓/ Dobermans were used ✓
Sample of 5 ml of blood was used ✓ (2)

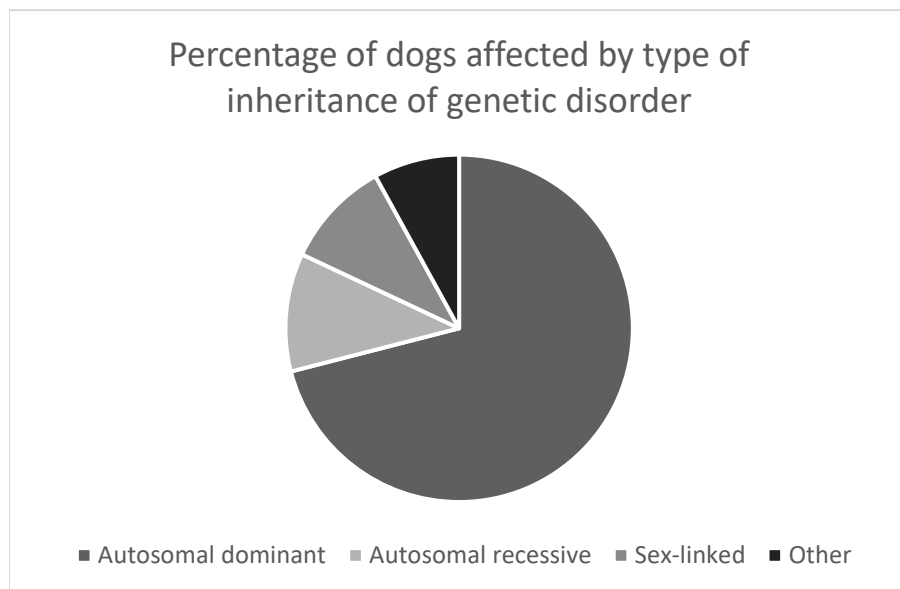
3.3.3 Genetic disorders are not affected by age ✓
Genetic disorders are inherited ✓/ born with the condition
Will be affected for their whole life ✓ **(any 2)** (2)

3.3.4 The allele for the genetic disorder will mask the effect of the allele without the disorder ✓
There are 76 autosomes ✓ on which the autosomal genetic disorder can occur
There are only 2 gonosomes ✓ on which the sex-linked genetic disorder can occur

OR

The allele for the genetic disorder will mask the effect of the allele without the disorder ✓
Autosomal: $76/78 \times 100 = 97\%$
Sex-linked: $2/78 \times 100 = 2,5\%$ (3)

3.3.5 $71/100 \times 360^\circ = 255,6$
 $11/100 \times 360^\circ = 39,6$
 $10/100 \times 360^\circ = 36$
 $8/100 \times 360^\circ = 28,8$



(6)
(14)

Rubric for marking graph

Criteria	Elaboration	Marks
Type (T)	Pie graph	1
Heading (H)	Both variables included	1
Calculations (C)	One to three segments were correctly calculated	1
	All four segments were correctly calculated	2
Plotting (P) (Don't measure, judge at a glance)	One to three segments correctly plotted and labelled	1
	All four segments correctly plotted and labelled	2

- 3.4.1 There was variation in the production of amylase in the grey wolf specie ✓
Some grey wolves had the genes to produce amylase, and others did not have these genes ✓
When wolves started to scavenge human food ✓ /when competition occurred
The animals with the ability to digest starch survived and reproduced ✓
And the animals without the ability to digest starch died ✓
The allele to produce amylase was passed on to the offspring ✓
A greater proportion of the wolves/dogs in the next generation had the ability to digest starch (6)

- 3.4.2 All dog breeds are genetically similar ✓
Can reproduce and produce fertile offspring ✓
- (2)
(8)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150



education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2025

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 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. 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 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 A possible explanation for an observation that can be tested is known as a ...

- A fact.
- B law.
- C theory.
- D hypothesis.

1.1.2 The lines of evidence that supports the idea of common ancestor for living hominids ...

- A biogeography, fossil evidence and genetic evidence.
- B modification by descent fossil evidence and genetic evidence.
- C fossil evidence, genetic evidence and cultural evidence.
- D fossil evidence and genetic evidence only.

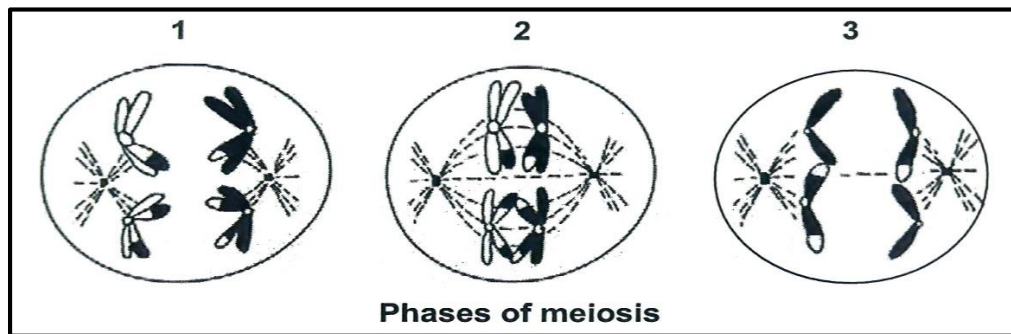
1.1.3 A small section of DNA has the following sequence of bases that codes for different amino acids:

GCT CGT TAA

Which ONE of the following is the CORRECT representation of the anticodons and number of amino acids coded for this section?

	ANTICODONS	NUMBER OF AMINO ACIDS
A	GCU CGU UAA	9
B	GCU CGU UAA	3
C	CGA GCA AUU	9
D	CGA GCA AUU	3

1.1.4 The diagram below represents different phases of meiosis.



The CORRECT order of the phases is ...

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

1.1.5 The scientist who discovered the fossil *Karabo* is ...

- A Ronald Clarke.
- B Lee Berger.
- C Mary Leakey.
- D Robert Broom.

1.1.6 Each gamete in the human female has ...

- A 22 autosomes and an X gonosome.
- B 22 autosomes and a Y gonosome.
- C 21 autosomes and XX gonosomes.
- D 21 autosomes and XY gonosomes.

1.1.7 Two parents without colour blindness have a son with colour blindness.

Which ONE of the following are the correct genotypes of the parents?

- A $X^D Y \times X^D X^D$
- B $X^d Y \times X^D X^D$
- C $X^D Y \times X^D X^d$
- D $X^D Y \times X^d X^d$

1.1.8 The following refers to reproduction in different organisms:

- (i) Breeding at different times of the year
- (ii) Fertile offspring
- (iii) Prevention of fertilisation
- (iv) Species specific courtship behaviour

Which ONE of the following is a combination of the reproductive isolating mechanisms?

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

1.1.9 A, B and O blood groups are inherited characteristics.

What would be the possible blood group of the offspring, when the parents have the genotype $I^A I^A$ and $I^A i$?

- A Blood group **O** only
- B Blood groups **A** and **O**
- C Blood group **AB**
- D Blood group **A** only

(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 1.2.10) in the ANSWER BOOK.

1.2.1 The RNA containing body, usually spherical, within the nucleus of cells

1.2.2 A complete set of chromosomes found in each nucleus of any individual of a particular species

1.2.3 A cleavage of cells cytoplasm that follows karyokinesis

1.2.4 An organelle that gives rise to the spindle in a dividing animal cell

1.2.5 The genus to which Little foot and Mrs Ples belongs

1.2.6 An undifferentiated cell that can form any other cell type in an organism

1.2.7 The type of variation where there is a range of different phenotypes for a particular characteristic

1.2.8 The organisms with similar characteristics and that are capable of random interbreeding to produce fertile offspring

1.2.9 The similar structures that are inherited from a common ancestor and are modified for different functions

1.2.10 The bond formed between two amino acids (10 x 1) **(10)**

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	Proposed the 'Law of Use and Disuse'	A:	Eldredge
		B:	Watson
1.3.2	An allele that is not shown in the phenotype when found in the heterozygous condition	A:	Dominant
		B:	Recessive
1.3.3	Breeding of organisms for human desire	A:	Natural selection
		B:	Artificial selection

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

- 1.4 Mendel observed some characteristics of the pea plant (*Pisum sativum*) which he suggested were controlled by inherited factors. He conducted a series of experiments in which he crossed pea plants with contrasting phenotypes to obtain the offspring of the **F₁** generation. At first his crosses were simple and involved only one pair of characteristics.

Mendel counted the number of offspring showing each of the variations.

His results are shown in the table below.

Plant part	Characteristics	P ₁ generation	F ₁ generation
Seed	Seed shape	Round x Oval	All round
	Seed colour	Yellow x Green	All yellow
Pod	Pod texture	Smooth x Wrinkled	All smooth
	Pod Colour	Green x yellow	All green
Flowers	Flower colour	Violet x yellow	All violet

- 1.4.1 Give the term for:

- (a) The inherited the factors that Mendel referred to (1)
- (b) A cross involving only ONE characteristic (1)

- 1.4.2 Name the female structure of the flower where meiosis occurs. (1)

- 1.4.3 Give the characteristics that is:

- (a) Dominant for flower colour (1)
- (b) Recessive for pod texture (1)

- 1.4.4 Which ONE of Mendel's Laws of inheritance is demonstrated by the **F₁** generation in the table above? (2)

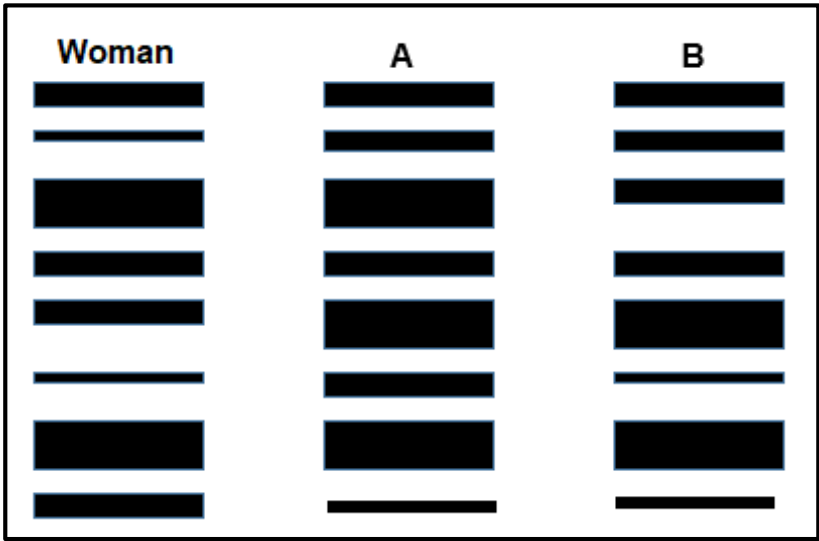
- 1.4.5 The **F₁** generation with round seeds (**R**) and violet flowers (**P**) are crossed.

- (a) What will be the phenotypic ratio of their offspring? (2)
- (b) State the genotype of the offspring that is heterozygous for the two characteristics. (1)
- (10)

1.5 A woman looking for her missing son went to the authorities.

A DNA profiling of the woman, her other son (**A**) and the bone fragment (**B**) obtained from the recently discovered decomposed remains of an unknown person was done.

The diagram below represents their DNA profiles.



- 1.5.1 What was used as source of DNA profile of decomposed remains? (1)
- 1.5.2 Do the remains belong to the woman’s missing son? (1)
- 1.5.3 Explain your answer to QUESTION 1.5.2. (2)
- 1.5.4 State TWO other uses of DNA profiling in humans. (2)
- (6)

TOTAL SECTION A: 50

SECTION B**QUESTION 2**

- 2.1 The sequence of amino acid in a protein molecule is coded for by DNA and RNA. The table below shows some mRNA codons and the corresponding amino acids.

AMINO ACID	mRNA CODONS
Serine	AGC, AGU
Aspartate	GAU, GAC
Leucine	CUA, CUC
Tyrosine	UAU, UAC
Phenylalanine	UUC, UUU
Glutamic acid	GAG

- 2.1.1 Name the site for protein synthesis in cells. (1)

- 2.1.2 A section of mRNA has the following base sequence and is read from left to right:

GAU CUC GAC AGC AUG ACC

Write down the names of the amino acids coded for by base triplets 3 and 4. (2)

- 2.1.3 Describe the effect of the mutation on protein formation if **GAC** changes to **GAU**. (2)

- 2.1.4 Describe the process of translation. (5)

- 2.1.5 Tabulate TWO differences between DNA replication and transcription. (5)
(15)

2.2 Read the extract below.

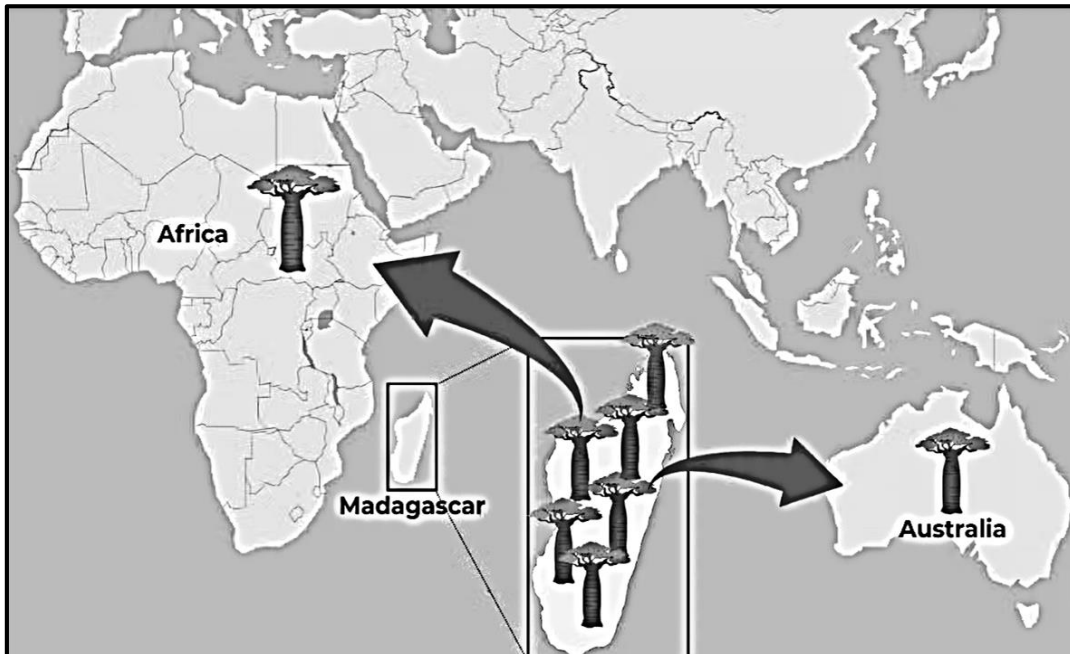
BAOBAB TREES ALL CAME FROM MADAGASCAR

The origin of this group of plants has fascinated people for a long time.

Baobabs are a remarkable keystone species capable of supporting a wide variety of animals for food and shelter.

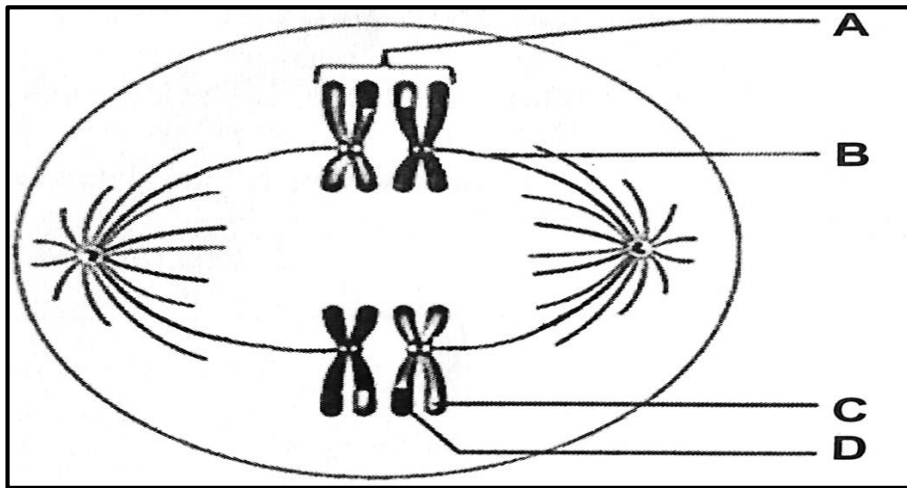
Researchers found that baobabs we see today all originated in Madagascar. They started evolving to form distinct species around 21 million years ago (mya). Later, two species evolved in Africa and Australia before the lineages went extinct in Madagascar.

The diagram below shows the distribution of baobab trees in Madagascar, Africa and Australia.



- 2.2.1 Identify the type of evidence for evolution shown in the diagram above. (1)
- 2.2.2 Give THREE other types of evidence for evolution. (3)
- 2.2.3 Distinguish between *speciation* and *extinction*. (2)
- 2.2.4 Describe how baobab trees in Africa and in Australia became different species. (6)
- (12)**

- 2.3 The diagram below represents some chromosomes in a human cell during a phase of meiosis.



- 2.3.1 Identify structure:

(a) **A** (1)

(b) **B** (1)

- 2.3.2 Identify the phase shown in the diagram above. (1)

- 2.3.3 Describe the events of the phase prior to the one shown in the diagram. (4)

- 2.3.4 Explain the role of crossing over in natural selection. (5)

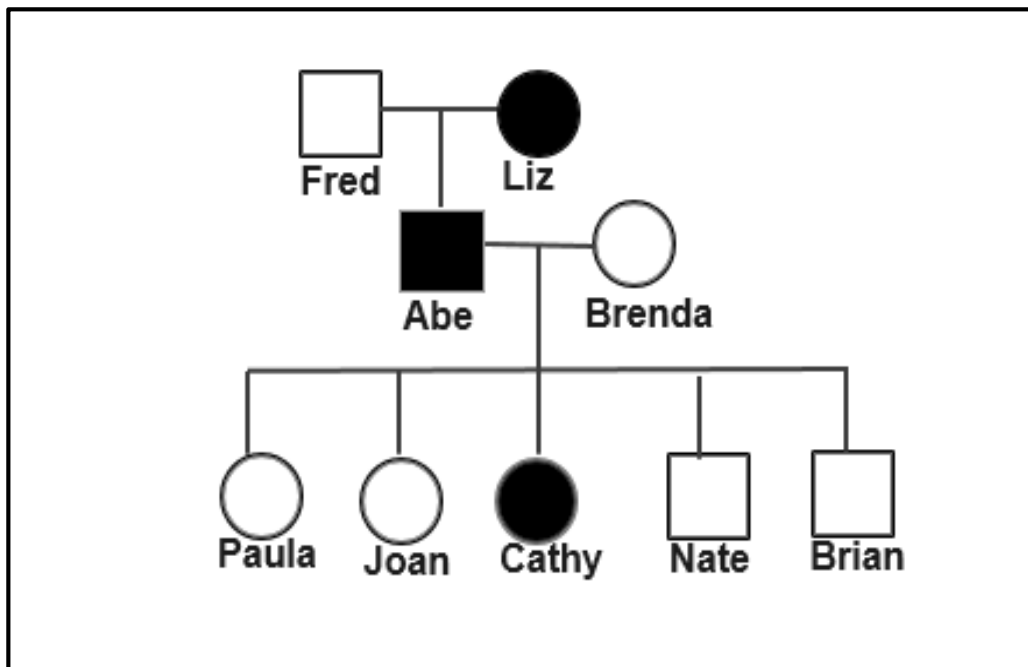
- 2.3.5 How many chromosomes would be present in each gamete at the end of meiosis? (1)

- 2.3.6 At the end of meiosis, one of the gametes had an extra chromosome 21.

Describe how this may have occurred. (2)

(15)

- 2.4 X-linked Alport syndrome is caused by a recessive allele (X^a). The pedigree diagram below shows the inheritance of this syndrome in a certain family.



2.4.1 Give the:

(a) Phenotype of Liz (2)

(b) Genotype of Nate (2)

2.4.2 How many males are definitely without X-linked Alport syndrome? (1)

2.4.3 Is Brenda homozygous or heterozygous? (1)

2.4.4 Explain your answer in QUESTION 2.4.3. (2)

(8)
[50]

QUESTION 3

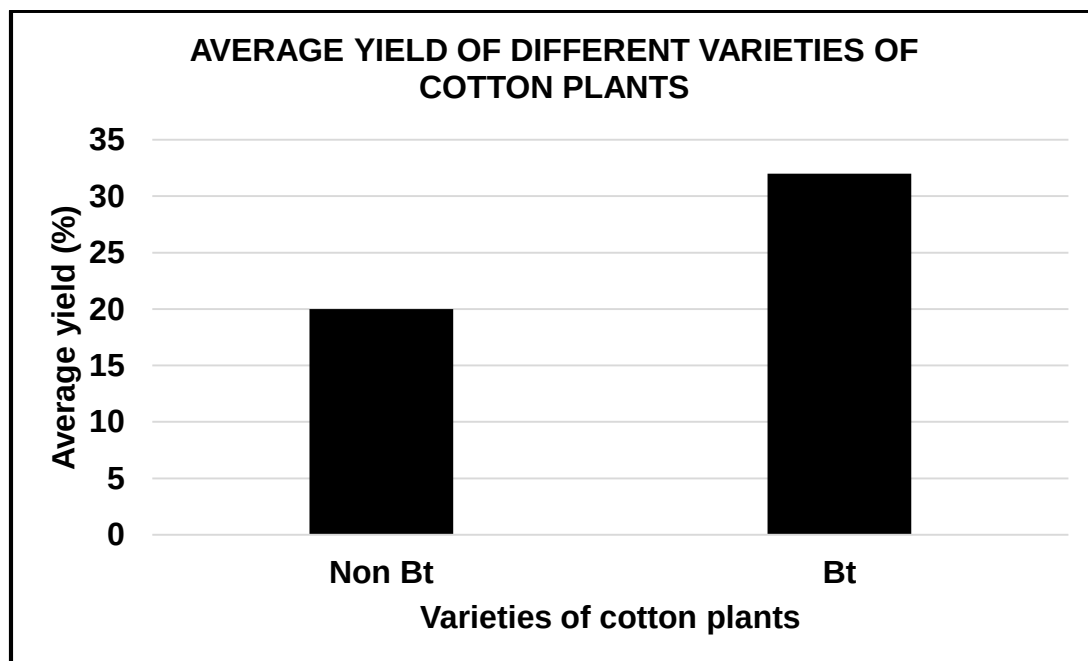
- 3.1 Bt cotton is genetically modified by inserting genes from the soil bacterium *Bacillus thuringiensis* (Bt) into cotton plants. When insects eat the cotton plant, the activated Cry-proteins attach to the insect's cells, forming ion channels that cause the cells to die.

An investigation was conducted to determine the effect of Bt-gene on the yield of cotton plants.

The procedure was as follows:

- A field was divided in two equal planting fields (**P** and **Q**)
- 500 Bt cotton plants were planted in one planting field (**P**) and 500 non Bt cotton plants in another planting field (**Q**)
- The environmental conditions for the two planting fields were exactly the same
- 500 insects of the same species were introduced into both planting fields
- All the cotton plants started flowering after 5 weeks and were counted in both planting fields **P** and **Q**
- The average yield in each planting field was calculated and used as an indication of insect resistance

The graph below shows the results at the end of the investigation.



3.1.1 State the aim of this investigation. (2)

3.1.2 Identify the:

(a) Independent variable (1)

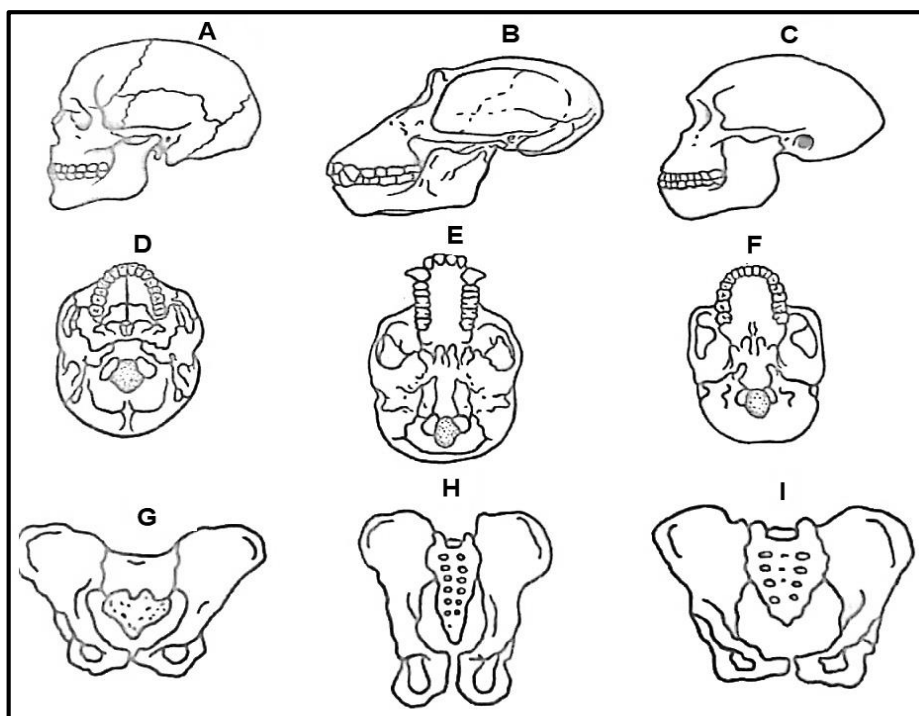
(b) Dependent variable (1)

3.1.3 State ONE way in which the validity of this investigation was ensured. (1)

3.1.4 Why was the average yield per plot calculated? (1)

3.1.5 State the conclusion for this investigation. (2)
(8)

3.2 The diagrams below represents the anatomical structures of three different primates.



3.2.1 Which ONE of the following structures (A–I) represent that of a human ...

(a) skull? (1)

(b) pelvis? (1)

3.2.2 Give a reason for your answer in QUESTION 3.2.1 (b). (2)

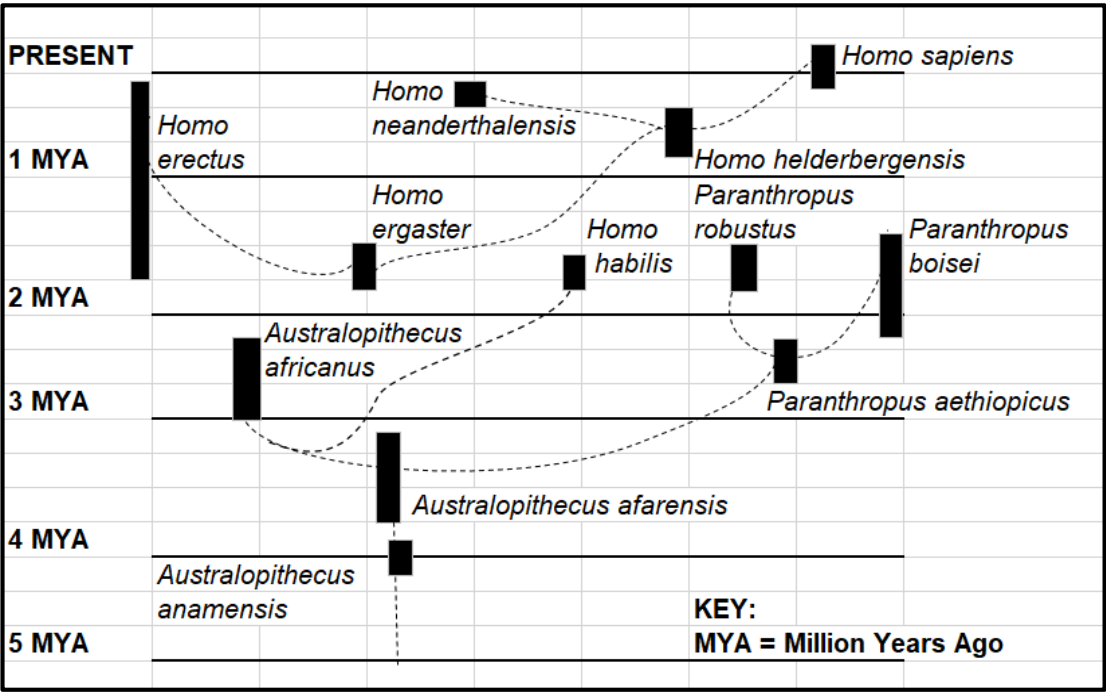
3.2.3 Explain the significance of the cranial size of skull A. (2)

3.2.4 Describe the changes in the position of the foramen magnum from quadrupedalism to bipedalism. (2)

3.2.5 Explain the relationship between the dentition and diet in hominin species D and E. (4)

3.2.6 Describe the shape of the spine of quadrupedal organisms. (1)
(13)

3.3 The diagram below shows possible evolutionary relationships among some hominids.



- 3.3.1 What is the above diagram called? (1)
- 3.3.2 What is the common ancestor to all species in the diagram? (1)
- 3.3.3 How many of EACH of the following are represented in the diagram above? (1)
- (a) Genera (1)
- (b) *Homo* species (1)
- 3.3.4 When did *Australopithecus africanus* first appear? (2)
- 3.3.5 Explain why *P. robustus* and *P. boisei* are more closely related. (2)
- 3.3.6 Name: (1)
- (a) The species that is a direct ancestor of *Homo habilis* (1)
- (b) The first hominid species to have moved out of Africa (1)
- 3.3.7 Describe how the fossils of the *Homo* species provide evidence for the 'Out of Africa' hypothesis. (3)
- (13)

- 3.4 The table below shows the results obtained in an investigation where purebred black lizards were crossed with brown lizards. The gene for black skin is dominant over the gene for brown skin.

The F₁ generation was used as parents (consisting of 4 breeding pairs) to produce the F₂ generation

GENERATIONS	NUMBER OF BLACK LIZARDS	NUMBER OF BROWN LIZARDS
P₁ generation	1	1
F₁ generation	12	0
F₂ generation		
Offspring of 1 st breeding pair	12	0
Offspring of 2 nd breeding pair	9	3
Offspring of 3 rd breeding pair	6	6
Offspring of 4 th breeding pair	12	4

- 3.4.1 Calculate the simplified phenotypic ratio of black lizards to brown lizards in the F₂ generation. Show ALL calculations. (2)
- 3.4.2 Provide evidence from the data to support the following statement:
The gene for black skin is dominant over the gene for brown skin. (2)
- 3.4.3 Draw a bar graph to show the phenotypic results of F₂ generation for the 3rd and 4th breeding pairs. (6)
(10)

- 3.5 A man with blood group A marries a woman with blood group B.

Use a genetic cross to show the possibility of them having ALL the blood groups in the F₁ generation.

(6)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150



PREPARATORY EXAMINATION

2025

MARKING GUIDELINES

LIFE SCIENCES (PAPER 2) (10832)
--

14 pages

Additional notes to the marking of Life Sciences Prelims P2 2025

- Many of these are concessions, they should not be taught in class.
- Any information in brackets is not compulsory for awarding marks
- Any text that is underlined is compulsory for the answer.

QUESTION 1

- 1.1. If the candidate gave more than one answer, they will get no marks e.g. 1.1.2 C/D X
- 1.2. If learners give more than one answer, or provide slash answers, they will lose the mark irrespective if the first option is correct or not. The exception is when the two terms given are different words for the same term e.g. quadraperpedalism/quadrapedal.

1.2.2 Accept quadruped

1.4.1 NOT DNA Profile (that is the collective sequence of bars of a person not the process of comparing the bars).

1.5.6 Genus name's first letter MUST be capitalized, and for the species name all MUST be in lowercase. Do not penalise if the candidate did not underline (this is a concession)

1.6.2 & 1.6.4 b) In place of Widow's peak, accept "hairline is curved, forming a point" (ALL must be included)

1.6.3.a) No mark for spermatogenesis/oogenesis (the question asked for arrows not arrow), Accept spermatogenesis AND oogenesis

1.6.4 a) No mark if there is a significant gap between the letters or a separator

e.g. HH Ff X

HH,Ff X etc.

Also don't accept if the letters are mixed HFHf X

Accept FfHH✓

1.6.4 b) In place of Freckles absent, accept "No/absent tiny brown spots"

QUESTION 2

2.1.2 The second bullet must clearly indicate that it is the two chromatids of different chromosomes that are overlapping. Alternative wordings include.

- Chromatids of maternal and paternal chromosomes overlap
- Inner chromatids of the chromosomes/homologous pair overlap, etc.

2.2.2 Long molecule, not accepted as long has to be relative to something else, mRNA is also long relative to tRNA etc.

Accept that the two strands run anti parallel

2.2.3. Accept is "the site of translation"

2.4.2 If the learner used Complete dominance and Co-dominance as table column headings, they will get 1 mark for the table and 2 marks for the headings being the first difference.

2.4.3 Accept just A/B/AB when in line with phenotype. Learners must be encouraged to write out blood group A etc. as in a sentence A, can be confusing for markers and learners will not get marks.

At F1 Phenotype, only look for the mention of Group A to award the mark.

QUESTION 3

3.1.5 If the learner refers to males, no marks for those parts, e.g. males have only one X chromosome, etc.

If a learners write, females have 2 XX, that is incorrect as it means 4 X chromosomes

3.3.2 Names of species must be mentioned with the characteristic for the description.

Accept "Temporal isolation" for breeding at different times of the year (Not in the exam guidelines!)

3.3.3 The word **population** is compulsory (if not mentioned, they get no marks). If mentioned once it suffices to give the marks after that. If it is replaced with species, the sentences are incorrect.

3.4.2 (The percentage of patients with TB's) development of resistance to Isoniazid antibiotic (over the years) *Do not penalise learners for including the aspects in brackets.

PRINCIPLES RELATING TO THE MARKING OF LIFE SCIENCES

1. **If more information than marks allocated is given**
Stop marking when maximum marks are reached and place a wavy line and 'max' in the right-hand margin.
2. **If, for example, three reasons are required and five are given**
Mark only the first three irrespective of whether all or some are correct/incorrect.
3. **If the whole process is given when only part of it is required**
Read all and credit relevant part.
4. **If comparisons are asked for but descriptions are given**
Accept if differences/similarities are clear.
5. **If tabulation is required but paragraphs are given**
Candidates will lose marks for not tabulating.
6. **If diagrams are given with annotations when descriptions are required**
Candidates will lose marks.
7. **If flow charts are given instead of descriptions**
Candidates will lose marks.
8. **If the sequence is muddled and links do not make sense**
Where the sequence and links are correct, credit. Where the sequence and links are incorrect, do not credit. If the sequence and links become correct again, resume credit.
9. **Non-recognised abbreviations**
Accept if first defined in the answer. If not defined, do not credit the unrecognised abbreviation but credit the rest of answer if correct.
10. **Wrong numbering**
If the answer fits into the correct sequence of questions, but the wrong number is given, it is acceptable.
11. **If language used changes the intended meaning**
Do not accept.
12. **Spelling errors**
If recognisable, accept the answer, provided it does not mean something else in Life Sciences or if it is out of context.

13. **If common names are given in terminology**
Accept, provided it was accepted at the memo discussion meeting.
14. **If only the letter is asked for and only the name is given (and vice versa)**
Do not credit.
15. **If units are not given in measurements**
Candidates will lose marks. Marking guidelines will allocate marks for units separately.
16. **Be sensitive to the sense of an answer, which may be stated in a different way.**
17. **Caption.**
All illustrations (diagrams, graphs, tables, etc.) must have a caption.
18. **Code-switching of official languages (terms and concepts)**
A single word or two that appear(s) in any official language other than the learner's assessment language used to the greatest extent in his/her answers should be credited, if it is correct. A marker that is proficient in the relevant official language should be consulted. This is applicable to all official languages.
19. **Changes to the marking guidelines**
No changes must be made to the marking guidelines without consulting the provincial internal moderator.

SECTION A**QUESTION 1**

1.1 1.1.1 D ✓✓

1.1.2 C ✓✓

1.1.3 B ✓✓

1.1.4 B ✓✓

1.1.5 B ✓✓

1.1.6 C ✓✓

1.1.7 B ✓✓

1.1.8 D ✓✓

1.1.9 D ✓✓

1.1.10 C ✓✓

(10 x 2) **(20)**

1.2 1.2.1 Phylogenetic tree ✓/Cladogram

1.2.2 Quadrupedalism ✓/Quadrupedal

1.2.3 Cranium ✓

1.2.4 Centriole ✓/Centrosome

1.2.5 Haemophilia ✓

1.2.6 Homozygous ✓

1.2.7 Chloroplast ✓

(7 x 1) **(7)**

1.3 1.3.1 B only ✓✓

1.3.2 None ✓✓

1.3.3 A only ✓✓

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

1.4	1.4.1	DNA profiling ✓	(1)
	1.4.2	(Child) B ✓	(1)
	1.4.3	B ✓ C ✓ (Mark first TWO only)	(2) (4)
1.5	1.5.1	(a) B ✓ (b) A ✓	(1) (1)
	1.5.2	Foramen magnum ✓	(1)
	1.5.3	Rectangular ✓/U-shaped	(1)
	1.5.4	B ✓	(1)
	1.5.5	A ✓	(1)
	1.5.6	<i>Homo sapiens</i> ✓	(1) (7)
1.6	1.6.1	Dihybrid ✓	(1)
	1.6.2	Widow's peak ✓ hairline	(1)
	1.6.3	(a) Gametogenesis✓/meiosis (b) Fertilisation ✓	(1) (1)
	1.6.4	(a) HHFf✓/HhFf (b) Straight hairline and freckles absent ✓	(1) (1) (6)

TOTAL SECTION A: 50

SECTION B

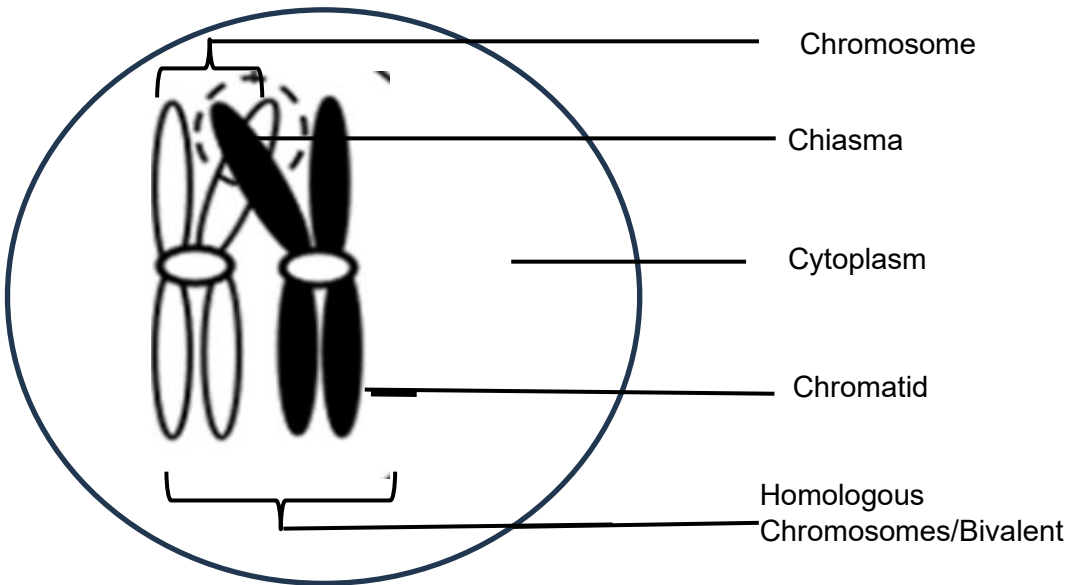
QUESTION 2

- 2.1 2.1.1 (a) Cell membrane ✓ (1)
 (b) Centromere ✓ (1)

- 2.1.2 **Crossing over** ✓*
 - Homologous chromosomes lie next to each other ✓
 - Adjacent/non-sister chromatids of each chromosomes overlap✓.
 - at points called chiasmata ✓
 - and genetic material is exchanged ✓
1* Compulsory mark + Any 3 (4)

- 2.1.3 - The gametes that form will be genetically different ✓/introduces genetic variation in gametes
 - leading to variation in the offspring ✓/increasing the gene pool.
 - It provides variation for natural selection to work on ✓/offspring are better adapted to a particular environment
 - The species has a better chance of survival ✓
Any 3 (3)

- 2.1.4 **Diagram showing (how chromosomes appear during) crossing over (in Cell B)**



Criteria	Description	Marks
Caption (C)	Including “crossing over”	1
Correct drawing (D)	Drawing showing crossing over at one point ONLY.	1
Shading (S)	One chromosome shaded and one chromosome unshaded	1
Labels (L)	1 label correct ANY 2 labels correct	1 2

(5)
(14)

2.2	2.2.1	(a) DNA ✓/Deoxyribonucleic acid	(1)
		(b) mRNA ✓/Messenger RNA	(1)
	2.2.2	- (Molecule A/DNA) is double-stranded ✓/Nitrogenous bases are held together by weak hydrogen bonds/base pairing occurs/A–T and C–G. - It has a double helix ✓ (shape). - It is composed of (monomers/smaller molecules called) nucleotides ✓. - It has the nitrogenous bases A, C, G and T ✓, /Has the nitrogenous base Thymine/T. - (Nucleotides) have deoxyribose sugar ✓ - and a phosphate. ✓/sugar-phosphate backbone	
		(Mark first THREE only)	Any (3)
	2.2.3	Site for protein synthesis ✓	(1)
	2.2.4	- Translation * ✓ - Each tRNA carries a <u>specific</u> amino acid. ✓. - When the anticodon on the tRNA ✓ - matches the codon on the mRNA ✓ - the tRNA brings the <u>required</u> amino acid to the ribosome. ✓ - Amino acids become attached to each other by peptide bonds ✓ - to form the <u>required</u> protein. ✓	
		1* Compulsory mark + Any 4	(5)
			(11)
2.3	2.3.1	- The mutation caused a change in the sequence of nitrogenous bases in the DNA ✓/the DNA base triplet changes. - This changed the mRNA sequence ✓/codon, - which in turn changed the tRNA sequence ✓/anticodon. - Hence, the fourth amino acid in Brian's protein is valine. ✓/Brian has two valines in his sequence/Brian has valine in place of proline.	(4)
	2.3.2	Eighteen ✓/18	(1)
	2.3.3	GAC ✓ TGC ✓	(2)
			(7)

2.4 2.4.1 45✓% (1)

2.4.2	(Dominance in) blood group A/complete dominance Complete dominance ✓ One allele is dominant, and the other is recessive ✓/recessive allele is present in the heterozygous state/ I^A is dominant over i. Only the dominant allele is expressed in the phenotype ✓/ recessive allele is masked in the phenotype.	(Dominance in) blood group AB/Co-dominance Co-dominance ✓ Both alleles are equally dominant ✓/no recessive allele is present in the heterozygous state /I^A is equally dominant to I^B. Both alleles are expressed in the phenotype. ✓
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(Mark first TWO only) (2 x 2) + (1)(T) table with column headings ✓ (5)

2.4.3 **P₁ Phenotype** Blood group B X Blood group AB ✓
Genotype $I^B i$ X $I^A I^B$ ✓
Meiosis
G/Gametes I^B i X I^A I^B ✓
Fertilisation

F₁ Genotype $I^A I^B$ $I^B I^B$ $I^A i$ $I^B i$ ✓
Phenotype Blood group AB
 Blood group B
Blood group A ✓

P₁ and F₁ ✓
 Meiosis and fertilisation ✓

OR

P₁ Phenotype blood group B X Blood group AB ✓
Genotype $I^B i$ X $I^A I^B$ ✓
Meiosis

G/Gametes

Fertilisation

	I^B	i
I^A	$I^A I^B$	$I^A i$
I^B	$I^B I^B$	$I^B i$

1 Mark for correct gametes ✓
 1 Mark for correct genotype ✓

F₁ Phenotype Blood group AB
 Blood group B
Blood group A ✓

P₁ and F₁ ✓
 Meiosis and fertilisation ✓

Any (6)
 (12)

- 2.5 2.5.1 Autosome ✓/autosomal (1)
- 2.5.2 Undifferentiated/unspecialised cells ✓ that can become into any type of cell/tissue ✓ in the body. (2)
- 2.5.3 - Stem cells with the CCR5-mutation can develop into new white blood cells, ✓
 - with a protein that has a different shape, ✓
 - therefore, the HI virus cannot attach to the white blood cells ✓
 - and cannot infect the white blood cells. ✓ Any (3)
(6)
[50]

QUESTION 3

- 3.1 3.1.1 - Shawl scrotum ✓/scrotum surrounds the penis
 - Undescended testes ✓
(Mark the first TWO only) Any (2 x 1) (2)
- 3.1.2 An allele that is masked in a heterozygous state/by the dominant allele ✓
 and, therefore, is not expressed in the phenotype. ✓
OR
 An allele that is only expressed in the phenotype ✓
 when in a homozygous state. ✓ (2)
- 3.1.3 3 ✓/Three (1)
- 3.1.4 (a) Male with AAS ✓ (1)
 (b) $X^A X^a$ ✓ (1)
- 3.1.5 - Females have two X chromosomes ✓/XX.
 - If they inherit one X chromosome with the recessive allele (for AAS), they may have another X chromosome that has a dominant allele. ✓/Females can be heterozygous/ $X^A X^a$.
 - The dominant allele/ X^A will mask the recessive allele/ X^a . ✓/in the heterozygous form they will not have AAS.
 - Only if they have two recessive alleles/ $X^a X^a$ will they have AAS. ✓ Any (3)
(10)
- 3.2 3.2.1 - Reduces genetic variation ✓
 - It is expensive. ✓
(Mark the first TWO only) (2)

- 3.2.2 - The nucleus of the ovum is haploid ✓/has half the chromosome number of a dog (the species)/does not have the complete genetic code
- and it does not contain the desired DNA/genetic information of the dog being cloned. ✓/it has the genetic material of another female dog.

OR

- When the nucleus of the skin cells is inserted in the ovum, it creates a diploid cell ✓/cell that has the full chromosome number of a dog
- and has all the desired DNA ✓/genetic information for the dog being cloned only.

OR

- If it was left, the result would be haploid plus diploid ✓/too many chromosomes/triploid.
- Which could be unviable ✓/Cause disorders/could be miscarried/spontaneous abortion.

(Any 2 x 2) (4)
(6)

- 3.3 3.3.1 - Similar organisms ✓/(Organisms) with similar characteristics
- Capable of interbreeding ✓
- Can produce fertile offspring ✓ (3)

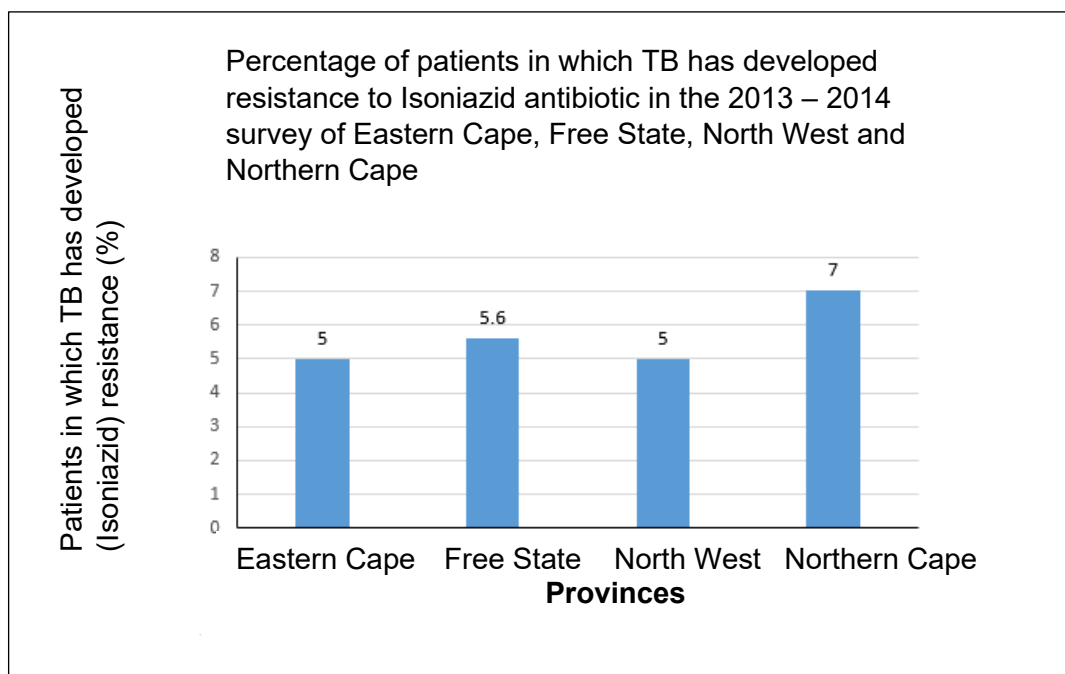
- 3.3.2 - Species-specific courtship behaviour ✓
- *H. ornate* males make a strong chorus, while *P. adspersus* males make a deep, low-pitched whoop. ✓
- Breeding at different times of the year ✓
- *H. ornate* breeds in summer, while *P. adspersus* breeds in spring. ✓ (4)

- 3.3.3 - If a **population** of a single species becomes separated by a geographical barrier ✓/example
- then the **population** splits into two. ✓
- There is now no gene flow between the two **populations**. ✓
- Since each **population** may be exposed to different environmental conditions ✓/the selection pressure may be different,
- natural selection occurs independently ✓ in each of the two **populations**
- such that the individuals of the two **populations** become different, ✓
- genotypically and phenotypically. ✓
- even if the two **populations** were to mix again, ✓
- they will not be able to interbreed. ✓

Any (6)
(13)

- 3.4 3.4.1 Natural selection ✓ (1)
- 3.4.2 Development of resistance to Isoniazid antibiotic ✓ (1)
- 3.4.3. Northern Cape ✓ (1)
- 3.4.4 - 349 patients (with TB) were selected. ✓
 - A survey was repeated in 2013 – 2014. ✓
 - The survey was conducted over a period of 2 years. ✓
(Mark the first ONE only) (1)
- 3.4.5 - All patients had TB. ✓
 - All the patients were over 18 years. ✓
 - All the patients' medical records were reviewed. ✓
 - All patients were from South Africa. ✓
 - Development of resistance was seen for the same medication ✓/
 Isoniazid/all were treated with the same antibiotic.
 - Same duration of the 2 surveys ✓/2 years each
(Mark the first TWO only) (2)
- 3.4.6 $\frac{5,0 + 5,6 + 4,7 + 4,3 + 4,2 + 6,3 + 5,0 + 7,0 + 6,1}{9}$ ✓ **OR** $\frac{48,2}{9}$
 = 5,36 ✓% (3)
- 3.4.7 The percentage of patients in which TB has developed resistance to Isoniazid antibiotic has increased over time ✓✓ (2)

3.4.8



Rubric for assessment of the graph

Criteria	Elaboration	Symbol	Mark
Type of graph	Bar graph drawn	T	1
Caption	Includes TB developed resistance to Isoniazid, years 2013 – 2014 and mention of 4 provinces/Eastern Cape, Free State, North West and Northern Cape	C	1
Labels	Correct label of X-axis and Y-axis (including unit %)	L	1
Scale	Correct scale for the Y-axis and equal spaces and width of bars on the X-axis	S	1
Plotting	1 – 3 co-ordinates correctly plotted ONLY 4 requested co-ordinates correctly plotted	P	1 2

- Histogram or line graph drawn - Lose marks for type of graph (**T**) and for scale (**S**)
- Transposed axes: - Can get full credit, if axes labels are also swapped and bars are horizontal - If labels are not corresponding, then lose marks for labels (**L**) and scale (**S**) - Check that the plotting is correct for the given labels

(6)
[17]

- 3.5 3.5.1 Out of Africa ✓ hypothesis (1)
- 3.5.2 - Mitochondrial DNA/mtDNA is passed on from mother to child. ✓
 - By studying mutations in Mitochondrial DNA ✓/mtDNA,
 - the female line of ancestors can be traced. ✓
 - It shows that the oldest female ancestor/s of modern humans is/are from Africa. ✓ Any (2)
- 3.5.3 Fossil ✓ evidence
(Mark the first ONE only) (1)

(4)
[50]**TOTAL SECTION B: 100****TOTAL: 150**



GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

2025

10832

LIFE SCIENCES

(PAPER 2)

LIFE SCIENCES: Paper 2



10832E

TIME: 2½ hours

MARKS: 150

19 pages

X05



P.T.O.

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, flow charts or tables 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 change in the characteristics of species over time is known as ...

- A a biological species.
- B a population.
- C a natural selection.
- D biological evolution.

1.1.2 Which of the following options is the correct combination of sources of variation?

- A Crossing over, random arrangement of chromosomes, mutations and mitosis.
- B Crossing over, random arrangement of chromosomes, continuous variation and random fertilisation.
- C Random mating, random fertilisation, mutations and meiosis.
- D Meiosis, mutations, discontinuous variation and continuous variation.

1.1.3 Evolution involving long periods of time during which species undergo little or no change, followed by short periods of time where species undergo rapid change through natural selection, is called ...

- A Lamarckism.
- B punctuated equilibrium.
- C artificial selection.
- D gradualism.

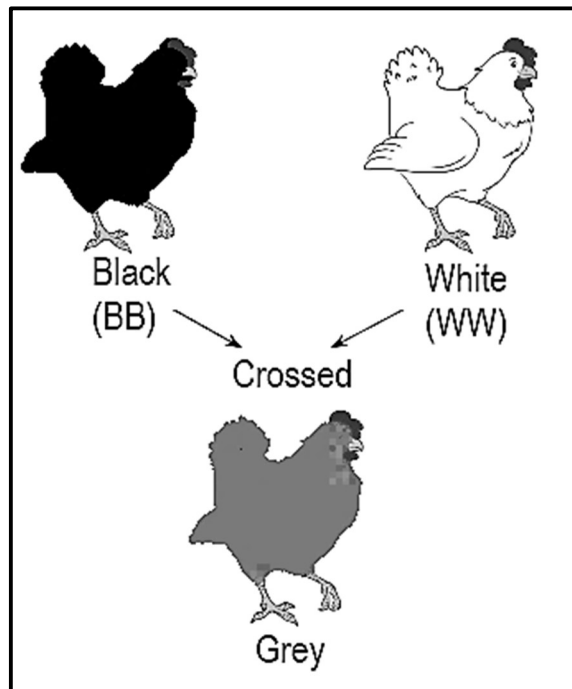
1.1.4 Which of the following fossils does not belong to the *Australopithecus africanus*?

- A Mrs Ples
- B Lucy
- C Little Foot
- D Taung Child

1.1.5 Which of the following is only found in an RNA nucleotide?

- A Adenine nitrogenous base
- B Uracil nitrogenous base
- C Deoxyribose sugar
- D Phosphate

QUESTIONS 1.1.6 AND 1.1.7 ARE BASED ON THE DIAGRAM BELOW.



[Source: Nagwa.com]

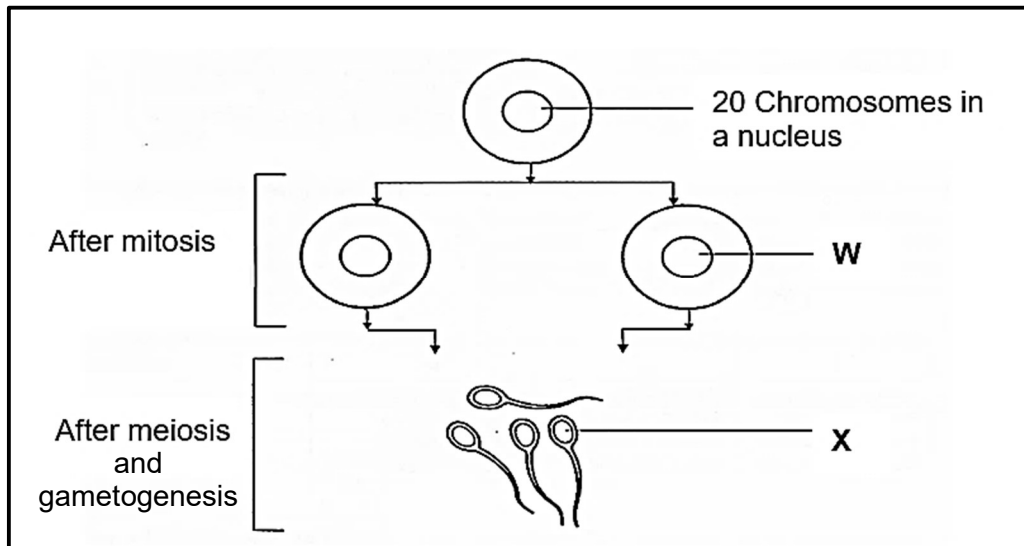
1.1.6 What type of dominance results in an intermediate phenotype as shown in the diagram above?

- A Co-dominance
- B Complete dominance
- C Incomplete dominance
- D Law of dominance

1.1.7 The genotype of the grey chicken is:

- A Bb
- B BW
- C WW
- D Bw

1.1.8 The diagram below shows the formation of the sperm cells of a fruit fly.

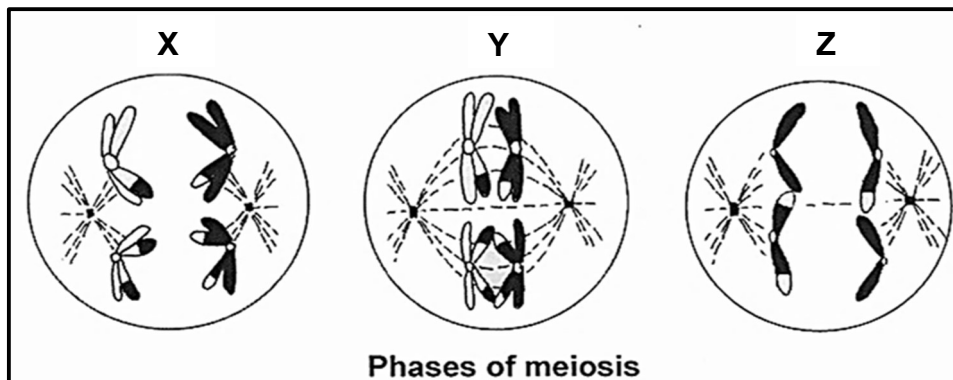


[Source: GP 2014 Prep P2]

How many chromosomes are present in the nucleus of cells **W** and **X**, respectively?

	W	X
A	10	20
B	10	10
C	20	20
D	20	10

1.1.9 The diagrams below represent different phases of meiosis.



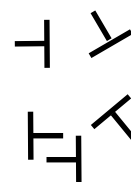
[Adapted from DBE Mind the Gap]

Which of the following represents the correct sequence of phases?

- A X, Y and Z
- B Y, Z and X
- C Z, X and Y
- D Y, X and Z

1.1.10 The diagram below shows a DNA molecule on the left and a pool of new nucleotides on the right.

Original DNA molecule



New nucleotides

If replication of the original DNA molecule takes place using the new nucleotides, what would the product of replication look like?

Write down the letter representing the correct product.

A	B	C	D

[Source: Coursehero.com]

(10 x 2) (20)

P.T.O.

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 1.2.7) in the ANSWER BOOK.

- 1.2.1 A diagram used to show the evolutionary relationships between species
- 1.2.2 The ability of a chimpanzee to walk on all four limbs
- 1.2.3 The part of the skull that houses the brain
- 1.2.4 The structure in an animal cell that gives rise to spindle fibres during cell division
- 1.2.5 A sex-linked genetic disorder whereby blood does not clot
- 1.2.6 The genetic state of having two identical alleles for a particular characteristic
- 1.2.7 An organelle containing DNA, found in plant cells and not in animal cells

(7 x 1) **(7)**

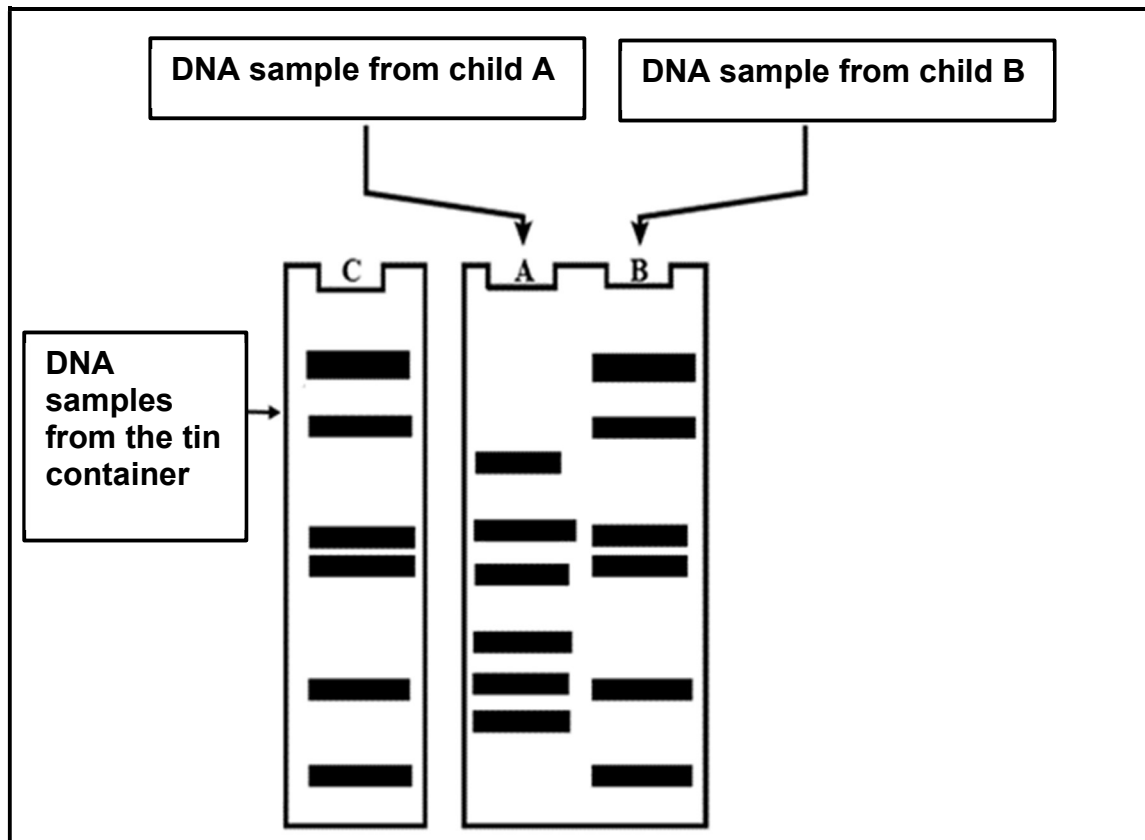
1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY, B ONLY, BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only, B only, both A and B** or **none** next to the question numbers (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 Law of use and disuse	A: Eldredge and Gould B: Lamarck
1.3.2 Chromosome complement of a woman with Down syndrome	A: 44 + XX B: 44 + XXX
1.3.3 Father of genetics	A: Mendel B: Watson

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

- 1.4 Mrs Forbes had baked a graduation cake for her sister and then left it in a tin container in the cupboard. When she returned from work, all that remained in the tin container were crumbs from the cake and traces of blood droplets, where the thief had grazed his/her finger on the sharp part of the container.

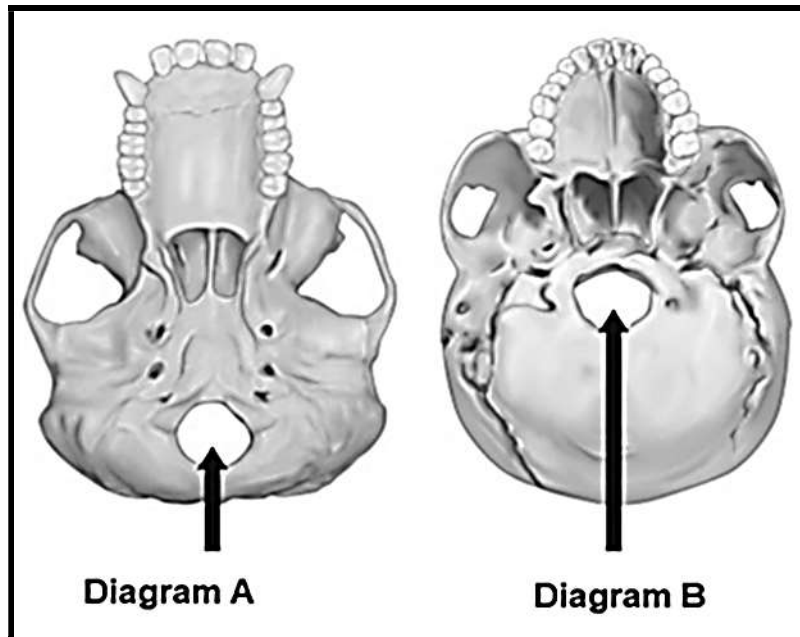
Below are the DNA samples of her two children, along with the DNA sample from the blood found on the tin container.



[Adapted from toppr.com/ask/]

- 1.4.1 Name the technique used to compare the DNA bars to identify the suspect. (1)
- 1.4.2 Give the letter of the child who most likely ate the cake. (1)
- 1.4.3 From the list below, write down the LETTERS of the TWO correct uses of the technique named in QUESTION 1.4.1. (2)
- A Cloning
 - B Identifying genetic disorders
 - C To establish family relations
 - D Genetic engineering
- (4)

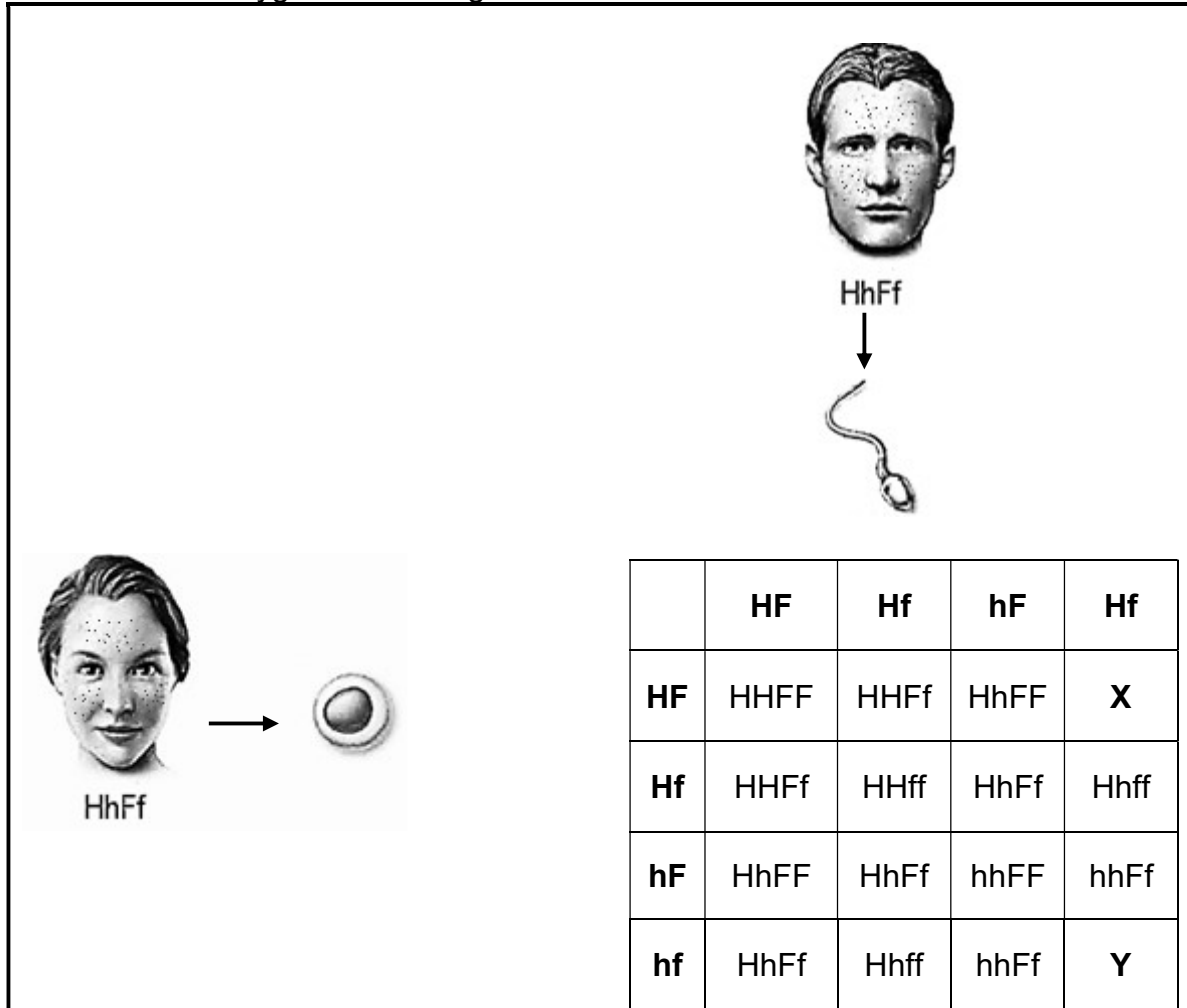
1.5 Diagrams **A** and **B** show the skulls of two hominids.



[Source: <https://ars.els-cdn.com/content/image>]

- 1.5.1 Which diagram (**A** or **B**) shows ...
- (a) a larger cranium? (1)
- (b) a skull of a chimpanzee? (1)
- 1.5.2 Name the opening to which the arrows are pointing. (1)
- 1.5.3 State the shape of the jaw in diagram **A**. (1)
- 1.5.4 Give the letter of the diagram (**A** or **B**) representing a bipedal hominid. (1)
- 1.5.5 Which skull in the diagram (**A** or **B**) is better adapted to eating raw, uncooked food? (1)
- 1.5.6 Give the scientific name of the modern human. (1)
- (7)

- 1.6 In humans, one gene controls hairline and another controls freckles. The hairline can be curved, forming a point down the forehead (called a widow's peak) (**H**) or straight (**h**). Freckles, which are tiny brown spots on the face, can be present (**F**) or absent (**f**). The diagram below shows a cross between a male and female who are both heterozygous for both genes.



[Adapted from *Shiken.ai*]

- 1.6.1 Name the type of genetic cross represented above. (1)
- 1.6.2 State the dominant characteristic of the hair line. (1)
- 1.6.3 Name the process in reproduction indicated by the: (1)
- (a) Arrows (1)
- (b) Punnett square (1)
- 1.6.4 Give the: (1)
- (a) Genotype of offspring **X** (1)
- (b) Phenotype of offspring **Y** (1)

(6)

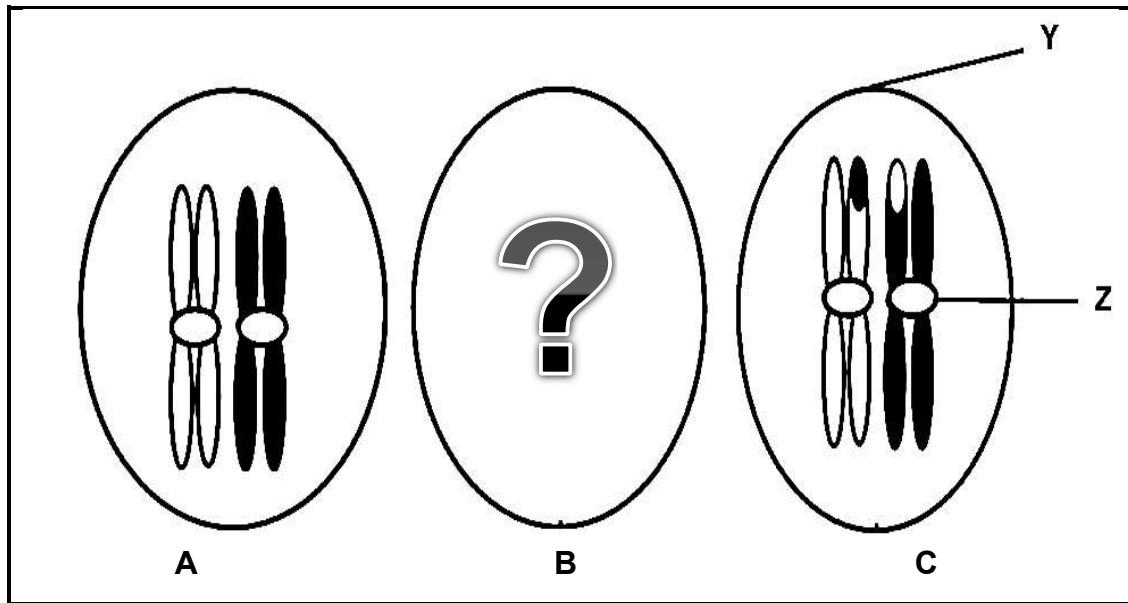
TOTAL SECTION A: 50

P.T.O.

SECTION B

QUESTION 2

- 2.1 The diagrams below represent a chromosome pair in a male human cell. The cells (**A**, **B** and **C**) show different events in a phase of meiosis.



[Adapted from DBE National Textbook]

- 2.1.1 Provide labels for the following structures:

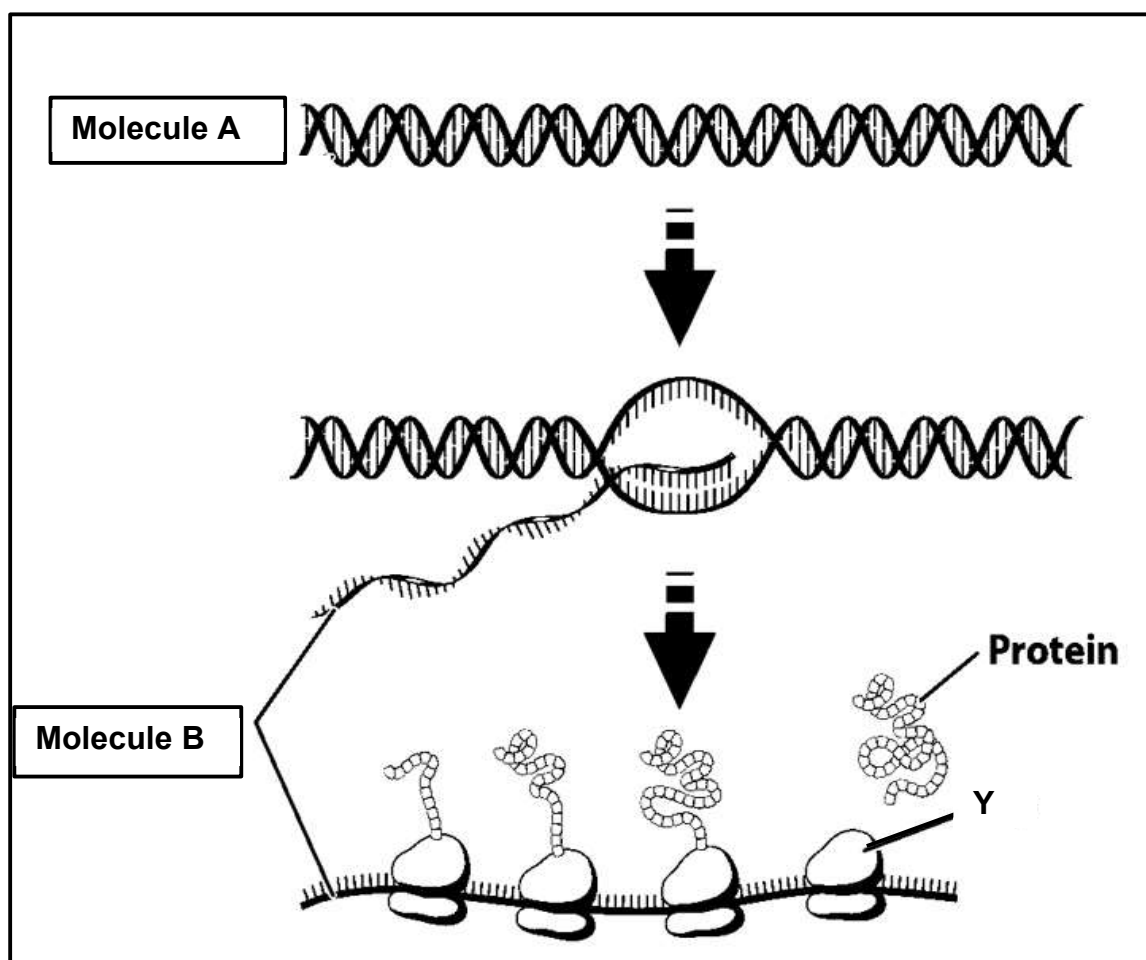
- (a) **Y** (1)
(b) **Z** (1)

- 2.1.2 Name and describe the process that caused the chromosomes in cell **C** to look different from the original chromosomes in cell **A**. (4)

- 2.1.3 Explain the impact of the process named in QUESTION 2.1.2 for the survival of a species. (3)

- 2.1.4 Draw a labelled diagram showing how the chromosomes would appear in cell **B** during the process named in QUESTION 2.1.2. (Do NOT include labels for **Y** and **Z**.) (5)
(14)

2.2 The diagram below represents processes that occur during protein synthesis.



[Source: <https://biotech.gsu.edu/2107/lecture24.html>]

2.2.1 Identify:

- (a) Molecule **A**
- (b) Molecule **B**

(1)
(1)

2.2.2 Describe THREE structural features of molecule **A**.

(3)

2.2.3 State the function of organelle **Y**.

(1)

2.2.4 Name and describe the stage of protein synthesis that takes place at organelle **Y**.

(5)
(11)

P.T.O.

- 2.3 The information below shows the sequences of a protein's first six amino acids found in the saliva of Angela and Brian. A mutation caused a change in Brian's sequence of amino acids. The amino acids are sequenced from left to right.

	Sequence of amino acids					
Angela	Glycine	Valine	Histidine	Proline	Isoleucine	Tyrosine
Brian	Glycine	Valine	Histidine	Valine	Isoleucine	Tyrosine

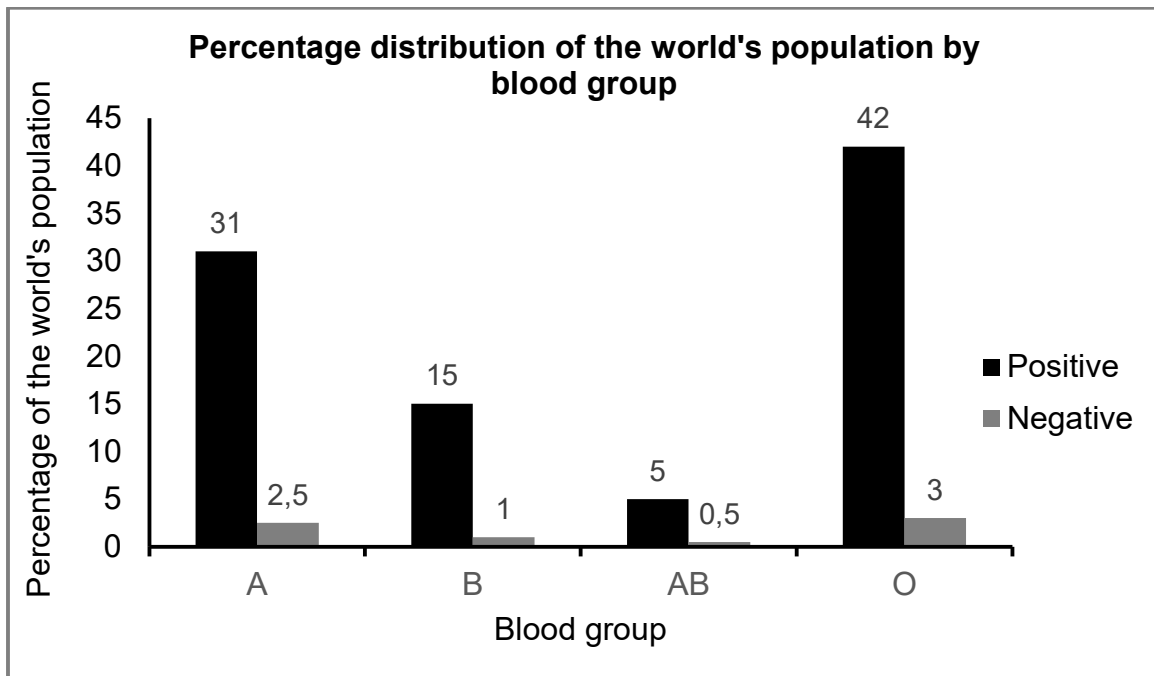
- 2.3.1 Describe how a mutation caused the change to Brian's amino acid sequence. (4)
- 2.3.2 How many mRNA nucleotides would be involved in forming the portion of the protein shown for Angela in the table above? (1)
- 2.3.3 A section of mRNA has the following base sequence and is read from left to right:

CUG ACG

Write down the DNA base triplet sequence (from left to right) for the mRNA sequence above.

(2)
(7)

- 2.4 The graph below shows the percentage distribution of the world's population according to blood groups A, B, AB and O, and whether they have the positive or negative forms.



[Source: *Worldatlas.com*]

- 2.4.1 According to the data, what is the total percentage of the world's population with blood group O? (1)
- 2.4.2 Tabulate TWO differences between the type of dominance shown by the inheritance of blood group A compared to blood group AB. (5)
- 2.4.3 Use a genetic cross to show how parents with the two least common blood groups in the world could have a child with blood group A. (6)
- (12)**

2.5

The CCR5 gene in humans is located on chromosome number 3. This gene is responsible for producing a protein on white blood cells. The HI virus normally uses this protein to attach to and infect white blood cells.

A mutation in the CCR5 gene appears to offer some protection against the HI virus by changing the shape of the protein on the white blood cells.

Scientists have discovered that long-term reduction of the HI virus in patients is possible through stem cell transplants from individuals with this mutation. Bone marrow is a rich source of adult stem cells. These stem cells can develop into new white blood cells.

[Adapted from link.springer.com]

- 2.5.1 Name the type of chromosome on which the CCR5 gene is found. (1)
- 2.5.2 Define a *stem cell*. (2)
- 2.5.3 Using the information provided, explain how stem cells from a person with the mutation could reduce the HI virus in patients. (3)
- (6)
- [50]

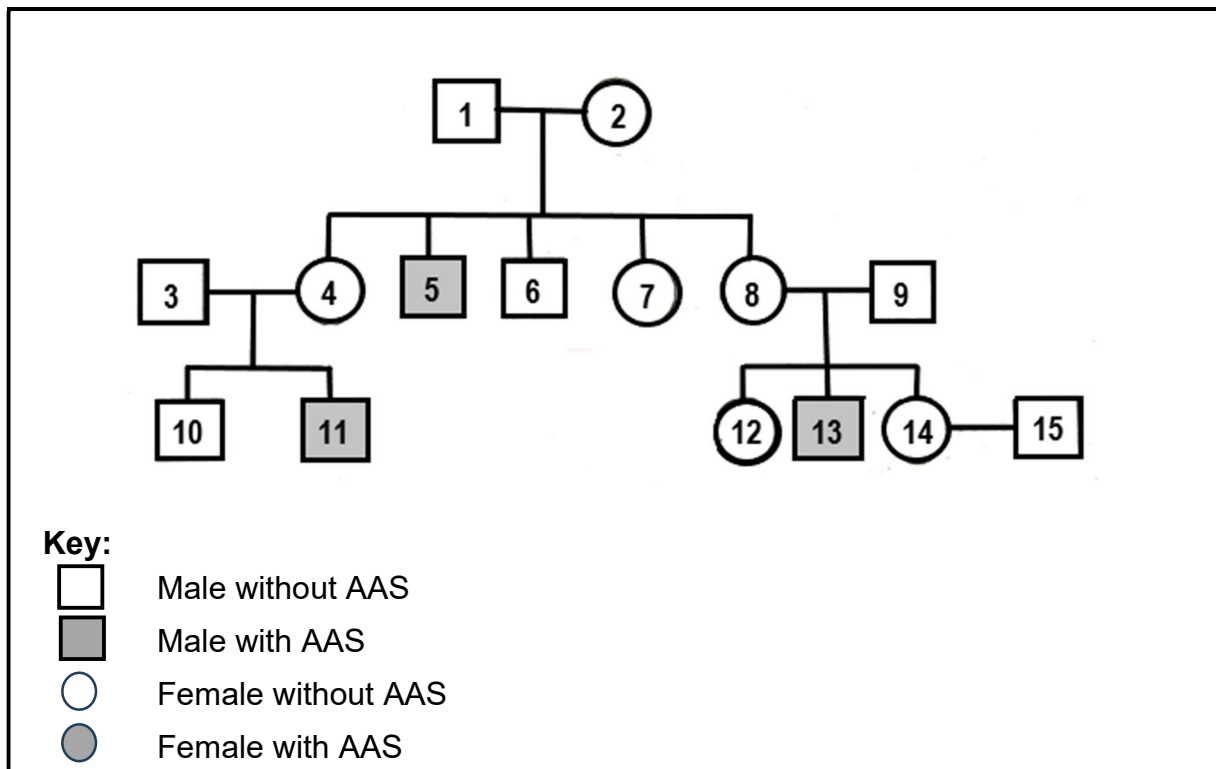
QUESTION 3

- 3.1 Aarskog-Scott syndrome (AAS) is a rare genetic disorder caused by a recessive allele (X^a) located on the X chromosome. The dominant allele (X^A) results in normal physical features.

People with AAS often have the following physical features:

- Widely spaced eyes
- A small nose
- A long area between the nose and mouth
- A widow's peak hairline
- A shawl scrotum (in which the scrotum surrounds the penis instead of hanging below)
- Undescended testes (Less often)

The pedigree diagram below shows the inheritance of AAS in a family.



[Source: Medlineplus.gov]

- 3.1.1 Using the information provided, state TWO characteristics of AAS that are unique to males. (2)
- 3.1.2 Define a *recessive allele*. (2)
- 3.1.3 How many offspring do individuals 8 and 9 have? (1)

P.T.O.

3.1.4 State the:

- (a) Phenotype of individual **11** (1)
- (b) Genotype of individual **4** (1)

3.1.5 Explain why females are less likely to inherit AAS. (3)
(10)

3.2

Cloning is a type of biotechnology used by people who want to keep their beloved dog in their lives. It allows them to produce a genetically identical dog to their previous one; however, it is a very expensive process and reduces genetic variation. During this process, the nucleus from the skin cell of the dog being cloned is removed and placed into the ovum of another female dog (from which the nucleus has been removed). Once the embryo of the cloned dog has formed, it gets implanted into the uterus of a surrogate female dog, where it will develop further until the cloned dog is born.

[Source: Shutterstock.com]

3.2.1 Based on the information above, state TWO disadvantages of cloning. (2)

3.2.2 Explain why the nucleus of the ovum was replaced with the nucleus of a skin cell. (4)
(6)

3.3

Frogs produce different sounds to attract females of the same species to the breeding site. The calls signal the start of a breeding season. *H. ornate* breeds in summer, and the males make strong chorus sounds. However, *P. adspersus* breeds in spring, and the males make deep, low-pitched whoops.

3.3.1 List THREE requirements that organisms must satisfy before they can be called a species. (3)

3.3.2 Use the text above to identify and describe TWO reproductive isolation mechanisms between these frog species. (4)

3.3.3 Frogs become reproductively isolated because they are different species. This may have happened due to geographic isolation. (6)
Describe speciation through geographic isolation. **(13)**

- 3.4 Tuberculosis (TB) is a bacterial infection caused by the bacterium *Mycobacterium tuberculosis*. TB can be life-threatening. Resistant strains of *Mycobacterium tuberculosis* have evolved because some patients do not complete their antibiotic treatment. Isoniazid is one of the antibiotics used as a first-line treatment for TB and to prevent TB from becoming active.

A survey conducted by the National Institute of Communicable Diseases from 2013 – 2014 compared the percentage of patients in whom TB has developed resistance to Isoniazid antibiotics with that of a 2001 – 2002 survey.

The 2013 – 2014 survey was conducted as follows:

- 349 patients with TB receiving treatment with Isoniazid were selected. They were from different South African hospitals or clinics in all nine provinces.
- All the patients were over 18 years of age.
- All the patients' medical records were reviewed.

The table below shows the percentage of patients in which TB has developed resistant to Isoniazid antibiotic in each of the 9 provinces for both surveys.

Province	The percentage of patients in whom TB has developed resistance to Isoniazid antibiotic over the years	
	2001 – 2002	2013 – 2014
Eastern Cape	3,5	5,0
Free State	3,7	5,6
Gauteng	1,3	4,7
KwaZulu-Natal	3,4	4,3
Limpopo	2,9	4,2
Mpumalanga	2,7	6,3
North West	1,4	5,0
Northern Cape	4,2	7,0
Western Cape	2,4	6,1

[Source: https://www.nicd.ac.za/assets/files/K-12750%20NICD%20National%20Survey%20Report_Dev_V11-LR.pdf]

- 3.4.1 Name the theory that Charles Darwin proposed to explain how *Mycobacterium tuberculosis* evolved to become antibiotic-resistant. (1)
- 3.4.2 Identify the dependent variable. (1)
- 3.4.3 Which province had the highest percentage of TB patients with resistance to Isoniazid in the 2013 – 2014 survey? (1)
- 3.4.4 State ONE way in which the reliability of this survey was ensured. (1)
- 3.4.5 Give TWO factors that were kept constant during this investigation. (2)

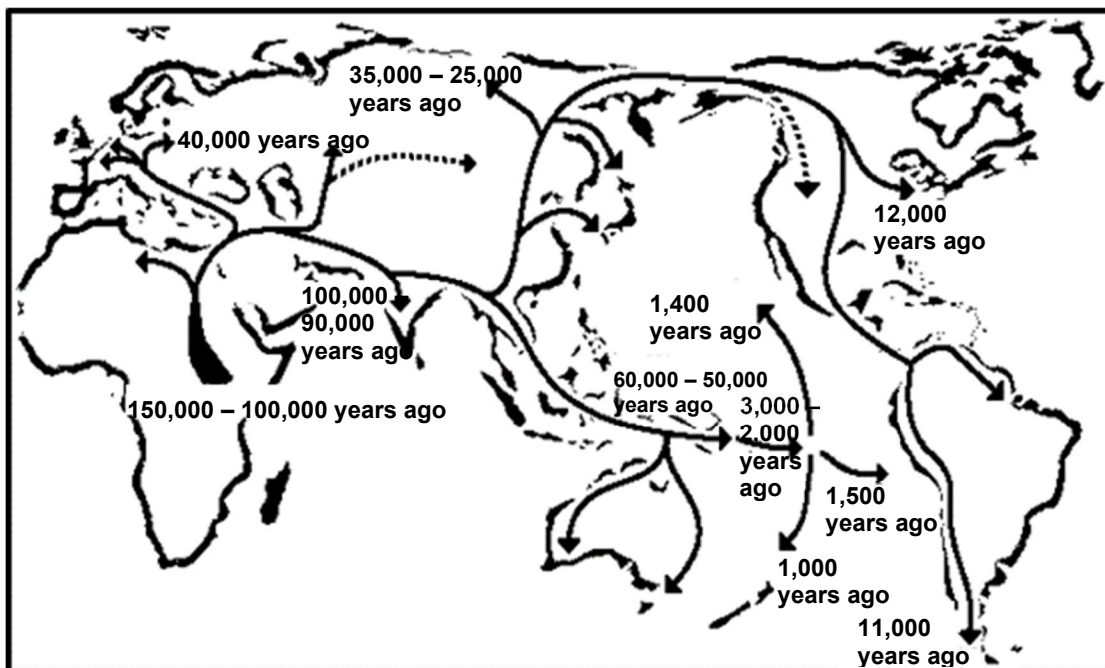
3.4.6 Calculate the average percentage of patients who had drug resistance to Isoniazid in South Africa during the 2013 – 2014 survey.

Show ALL calculations. Round-off your answer to two decimal places. (3)

3.4.7 Use the information in the table to formulate a conclusion for this survey. (2)

3.4.8 Draw a bar graph representing the 2013 – 2014 survey results for the Eastern Cape, Free State, North West and Northern Cape only. (6)
(17)

3.5 The map below represents a hypothesis used in evolution to describe the origin of modern humans based on the ages of fossils discovered worldwide.



[Source: <https://factsanddetails.com/archives/003/201810/5bd26afc8eef2.png>]

3.5.1 Identify the hypothesis represented by the map above. (1)

3.5.2 Describe how genetic evidence can support the hypothesis identified in QUESTION 3.5.1. (2)

3.5.3 Name ONE type of evidence used to support the hypothesis identified in QUESTION 3.5.1 other than genetic evidence. (1)

(4)

[50]

TOTAL SECTION B: 100

TOTAL: 150

END