Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

NATIONAL
SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2025

LIFE SCIENCES P2

MARKS: 150

TIME: 2½ hours

This question paper consists of 15 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1.   Answer ALL the questions.

2.   Write ALL the answers in the ANSWER BOOK.

3.   Start the answer to EACH question at the top of a NEW page.

4.   Number the answers correctly according to the numbering system used in this question paper.

5.   Present your answers according to the instructions of each question.

6.   ALL drawings MUST be done in pencil and labelled in blue or black ink.

7.   Draw diagrams, tables or flow charts ONLY when asked to do so.

8.   The diagrams in this question paper are NOT necessarily drawn to scale.

9.   Do NOT use graph paper.

10.   You must use a non-programmable calculator, protractor and a compass, where necessary.

11.   All calculations to be rounded off to TWO decimal places.

12.   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, for example 1.1.11 D.

　　　1.1.1   Which organelle represents the location of extra-nuclear DNA in animal cells?

　　　　　A   Cytoplasm
　　　　　B   Nucleus
　　　　　C   Mitochondria
　　　　　D   Chloroplasts

　　　1.1.2   The main purpose of a genetic cross/diagram is to …

　　　　　A   measure DNA sequences.
　　　　　B   determine genetic mutations.
　　　　　C   predict the probability of the offspring characteristics.
　　　　　D   solve criminal cases.

　　　1.1.3   Which ONE of the following is the significance of DNA replication?

　　　　　A   Chromatin network condenses
　　　　　B   Complementary pairing of nitrogenous bases
　　　　　C   Weak hydrogen bonds break
　　　　　D   Genetic material is doubled

　　　1.1.4   Biological evolution refers to the …

　　　　　A   formation of a new species.
　　　　　B   gradual change in the characteristic of a species over time.
　　　　　C   present-day distribution of species across the world.
　　　　　D   structures that have the same basic plan but are adapted for different functions.

　　　1.1.5   Peacocks use bright colours to attract a mating partner.

　　　　　This reproductive isolating mechanism is called …

　　　　　A   hybrid infertility.
　　　　　B   reproduction at different times of the year.
　　　　　C   species-specific courtship behaviour.
　　　　　D   copulation.

　　　　　　　　　　　　　　　　　　　Please turn over

1.1.6   The scientists who played a role in the discovery of the DNA molecule.

A   Mendel and Crick.
B   Dart and Broom.
C   Watson and Darwin.
D   Franklin and Wilkins.

1.1.7   The difference between genotype and phenotype is that ...

A   genotype is the genetic make-up while phenotype is the external appearance.
B   genotype is an allele inherited from maternal origin while phenotype is an allele of paternal origin.
C   genotype is the external appearance while phenotype is the genetic make-up.
D   genotype is inherited while phenotype is not.

1.1.8   The graph below shows the average height of the giraffes in different time periods used by Lamarck in his evolution theory.
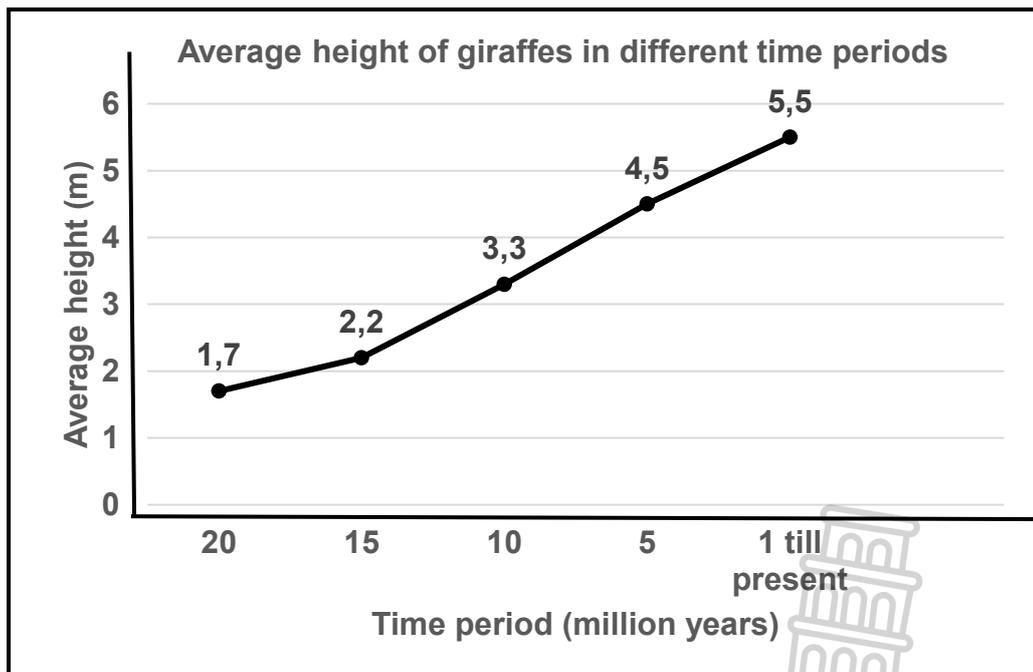
Which ONE of the following shows the correct percentage increase in the height of giraffes at different time periods?

	TIME PERIOD (Million years)	PERCENTAGE INCREASE
A	20–15	2,2%
B	15–10	33,3%
C	10–5	1,2%
D	5–1 till present	22,2%

Please turn over

1.1.9 The ultimate purpose of artificial selection is to …

A increase genetic variation in a population.
B allow organisms to survive in their natural environments.
C reduce the size a population of a species by removing organisms with undesirable traits.
D increase organisms with specific desirable traits for human benefit.

1.1.10 Which organic catalyst is used to cut a plasmid in genetic engineering?

A Enzyme
B Stem cell
C Recombinant DNA technology
D Bacteria (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 1.2.8) in the ANSWER BOOK.

1.2.1 A pattern of black bars/bands on x-ray film when a sample is put through special biotechnical process

1.2.2 A fluid that has free RNA nucleotides complementary to a DNA strand

1.2.3 The type of dominance that produces an intermediate phenotype in a heterozygous condition

1.2.4 The type of barrier in speciation that splits a single population into sub-populations

1.2.5 A reproductive isolating mechanism that occurs in flowers only

1.2.6 A genetic disorder resulting from a mutation caused by the absence of blood-clotting factors

1.2.7 A source of variation where any individual in a population has an equal chance of mating with any other individual

1.2.8 The evolution theory proposed by Eldrege and Gould (8 x 1) (8)

6 **LIFE SCIENCES P2** **(EC/SEPTEMBER 2025)**

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	A component of a nucleotide found in DNA and RNA	A	Phosphate group
		B	Ribose sugar
1.3.2	Segment of DNA that codes for a particular trait	A	Gene
		B	Locus
1.3.3	An advantage of bipedalism	A	Wider view of the surrounding environment
		B	Climbing trees faster

(3 x 2)   (6)

1.4 The diagrams below show metaphase in different cell divisions in an organism.

Diagram 1   **Diagram 2**

1.4.1 Which diagram (**1** or **2**) represents a phase in:
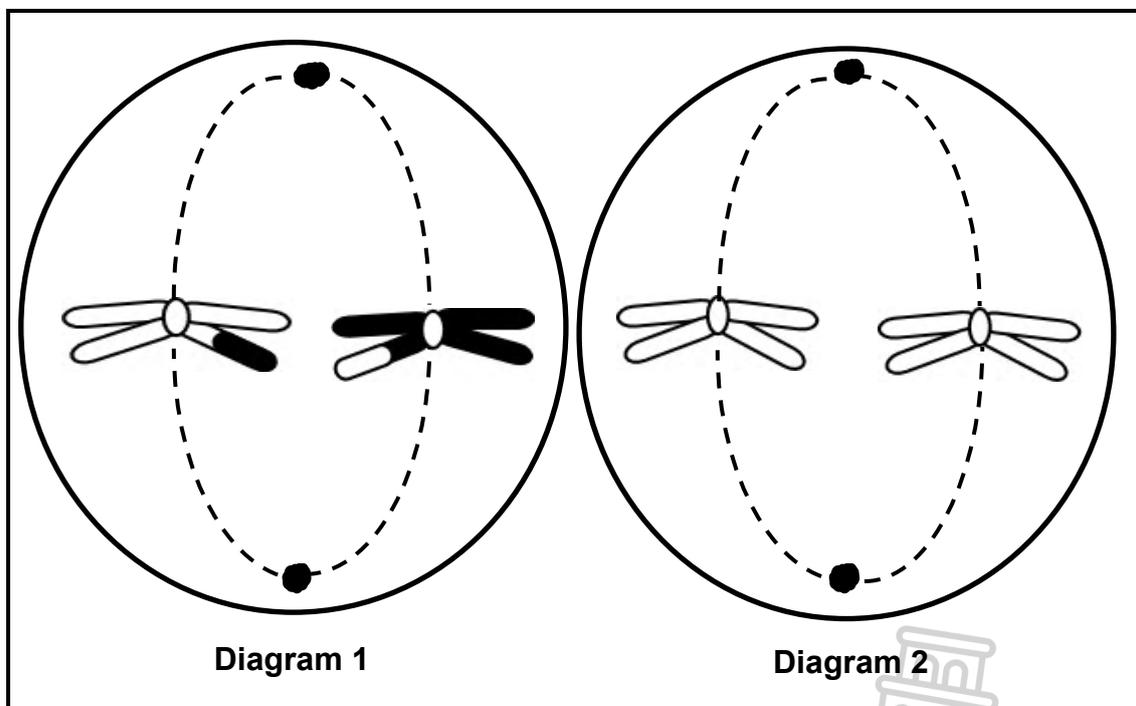
(a) Meiosis   (1)

(b) Mitosis   (1)

1.4.2 Name the process that occurred in the cell division in diagram **1** that has resulted in chromosomes appearing differently.   (1)

1.4.3 In which phase does the process named in QUESTION 1.4.2 occur?   (1)

1.4.4 Name the type of cells in which the cell division in diagram **2** occurs. (1)

1.4.5 State the diploid number of chromosomes for the cell in diagram:

    (a) **1** (1)

    (b) **2** (1)

1.4.6 Give the number of chromatids in diagram **1**. (1)

1.5 In the Capercaillie bird species, dark feather colour **(D)** is dominant over light feather colour **(d)** and long tail **(L)** masks the expression of short tail length.

The Punnet square below shows possible results when the gametes of the parents were crossed.

			Parent 1		
	GAMETES	**DL**	**Dl**	**dL**	**dl**
Parent 2	**Dl**	**X**	**DDll**	**DdLl**	**Ddll**
	Dl	**DDLl**	**DDll**	**DdLl**	**Ddll**
	dl	**DdLl**	**Ddll**	**ddLl**	**ddll**
	dl	**DdLl**	**Ddll**	**ddLl**	**ddll**

1.5.1 Name the type of cross represented by the Punnet square above. (1)

1.5.2 Write the genotype of the offspring at **X**. (1)

1.5.3 State the:

    (a) Phenotype of parent **2** (2)

    (b) Type of dominance in tail length. (1)

1.5.4 Which Parent (**1** or **2**) has a heterozygous genotype for both characteristics? (1)

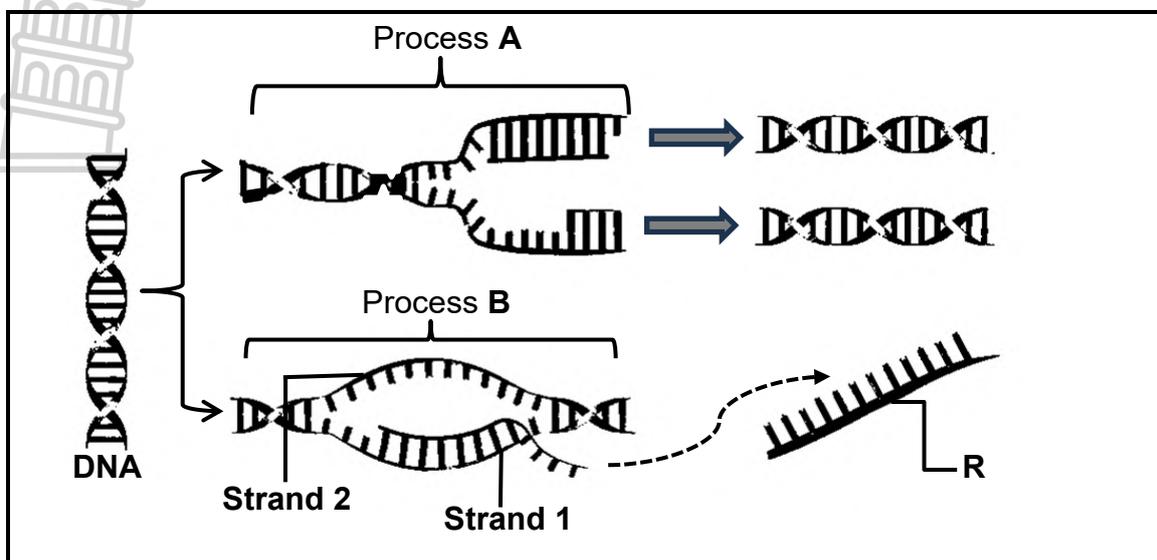1.5.5 Name TWO Mendelian principles that describe the separation of alleles during gamete formation. (2)

TOTAL SECTION A: **50**

8 LIFE SCIENCES P2   (EC/SEPTEMBER 2025)
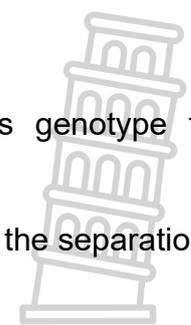
SECTION B

QUESTION 2

2.1   The diagram below shows different processes involving a DNA molecule.

2.1.1   Identify process:

(a)   **A**   (1)

(b)   **B**   (1)

2.1.2   Name the organelle where processes **A** and **B** occur in a cell.   (1)

2.1.3   State the phase in the cell cycle in which the events of process **A** take place.   (1)

2.1.4   Describe the events that occur during protein synthesis after molecule **R** attaches to the ribosomes.   (5)

2.1.5   Explain ONE functional relationship between DNA and molecule **R**.   (2)

2.1.6   The table below shows the amino acids coded for by DNA nucleotides for the formation of molecule **R** in process **B**.

Base triplet	DNA nucleotides on strand 1	Amino acid
1	TGC	Cystine
2	TAC	Tyrosine
3	AGG	Arginine
4	ACG	Threonine

(a)   Use the table above to determine the codons on molecule **R** for base triplets 1, 2 and 3.   (2)

(b)   Determine the amino acid for the DNA base triplet that is complementary to TGC on **strand 2**.   (2)

2.2 The karyotype below is of a male individual suffering from Jacob's syndrome.
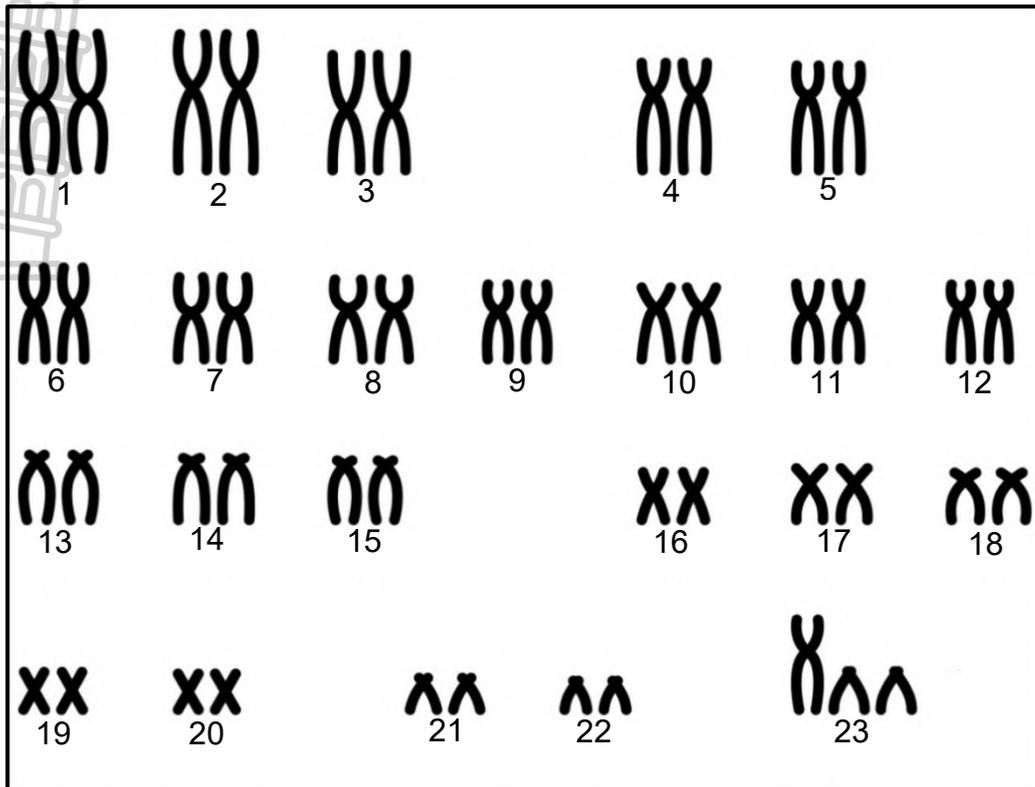
2.2.1 Name the type of mutation that has caused Jacob's syndrome in this individual. (1)

2.2.2 For this individual, determine the number of:

    (a) Autosomes (1)

    (b) Gonosomes (1)

2.2.3 Using LETTERS (X and Y), write the gonosomes of this individual with Jacob's syndrome. (1)

2.2.4 Describe ONE way in which the karyotype of a person with Down syndrome would differ from the one mentioned in QUESTION 2.2.3. (3)

2.2.5 Explain how the error during gamete formation in meiosis II could have resulted in Jacob's syndrome. (6)

10 **LIFE SCIENCES P2** **(EC/SEPTEMBER 2025)**

2.3 The pedigree diagram below shows the inheritance of blood groups in a family. *(The phenotypes of the individuals are indicated in the different shapes.)*
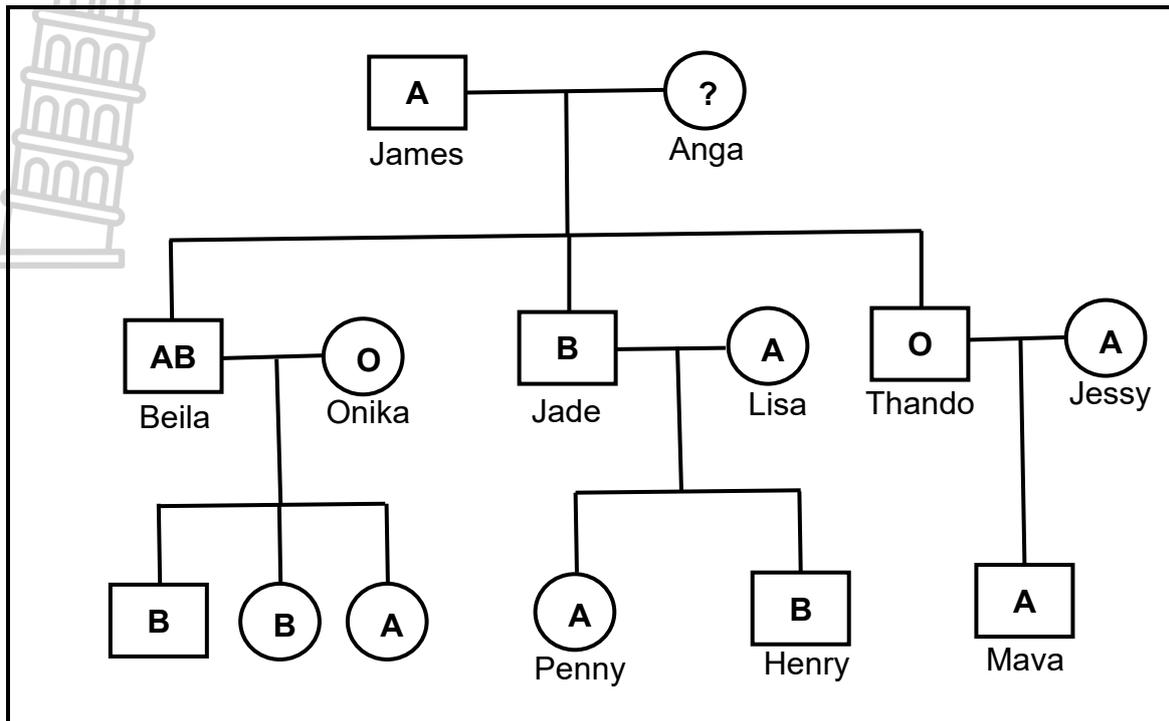
2.3.1 State the:

    (a) Phenotype of Anga (1)

    (b) Genotype of the individual that displays co-dominance (1)

2.3.2 Give the number of individuals with homozygous recessive alleles in this pedigree diagram. (1)

2.3.3 Explain why the future children of Jade and Lisa could display different blood groups compared to their current children. (3)

2.3.4 Use a genetic cross to show the percentage probability of Beila and Onika having a child with blood group O. (6)

     Please turn over

2.4 The diagram below illustrates a biotechnological process (cloning) that produces an entire organism.
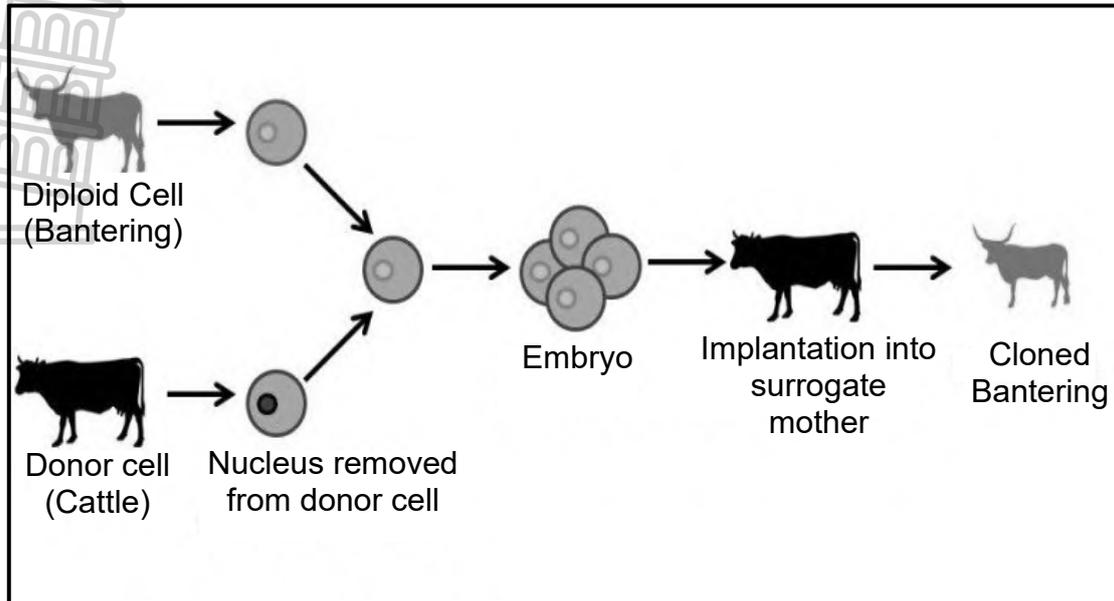
2.4.1 Name the:

(a) Type of cell produced by meiosis that is extracted from the donor cattle. (1)

(b) Organ where implantation will occur in the surrogate mother. (1)

2.4.2 Cattle accounted for 63,3% of the 395 different cloned animals in a particular country.

Calculate the total number of cattle that were cloned in this country. Show ALL working. (Round-off your answer to NO decimal place) (3)

2.4.3 Explain how the process of cloning will affect variation in a cattle population. (2)

2.4.4 Suggest THREE characteristics desired by humans that influence them to clone cattle. (3)

[50]

QUESTION 3

3.1 Colour-blindness is a sex-linked genetic disease that is caused by a genetic defect on the X-chromosome in humans. People with colour-blindness cannot differentiate between certain colours.

The table below shows the prevalence of colour-blindness in males in different regions of the world.

REGION	% prevalence of males with Colour-blindness
Europe	7
North America	8
East Asia	5
South Asia	8
Middle/North Africa	10
Sub-Sahara Africa	3
South America	6
Oceania	7

3.1.1 According to the table above, which region has the lowest percentage of males with colour-blindness? (1)

3.1.2 Suggest ONE reason why the results of the region identified in QUESTION 3.1.1 might not be accurate. (1)

3.1.3 The prevalence of colour-blindness in females is 0.5% globally.

Explain why females have lower chances of being colour-blind. (2)

3.1.4 Draw a bar graph to show the percentage prevalence of males with colour-blindness in African and Asian regions. (6)

3.2 The diagram below shows the skulls of hominid ancestors and tools they used as part of their evolution.
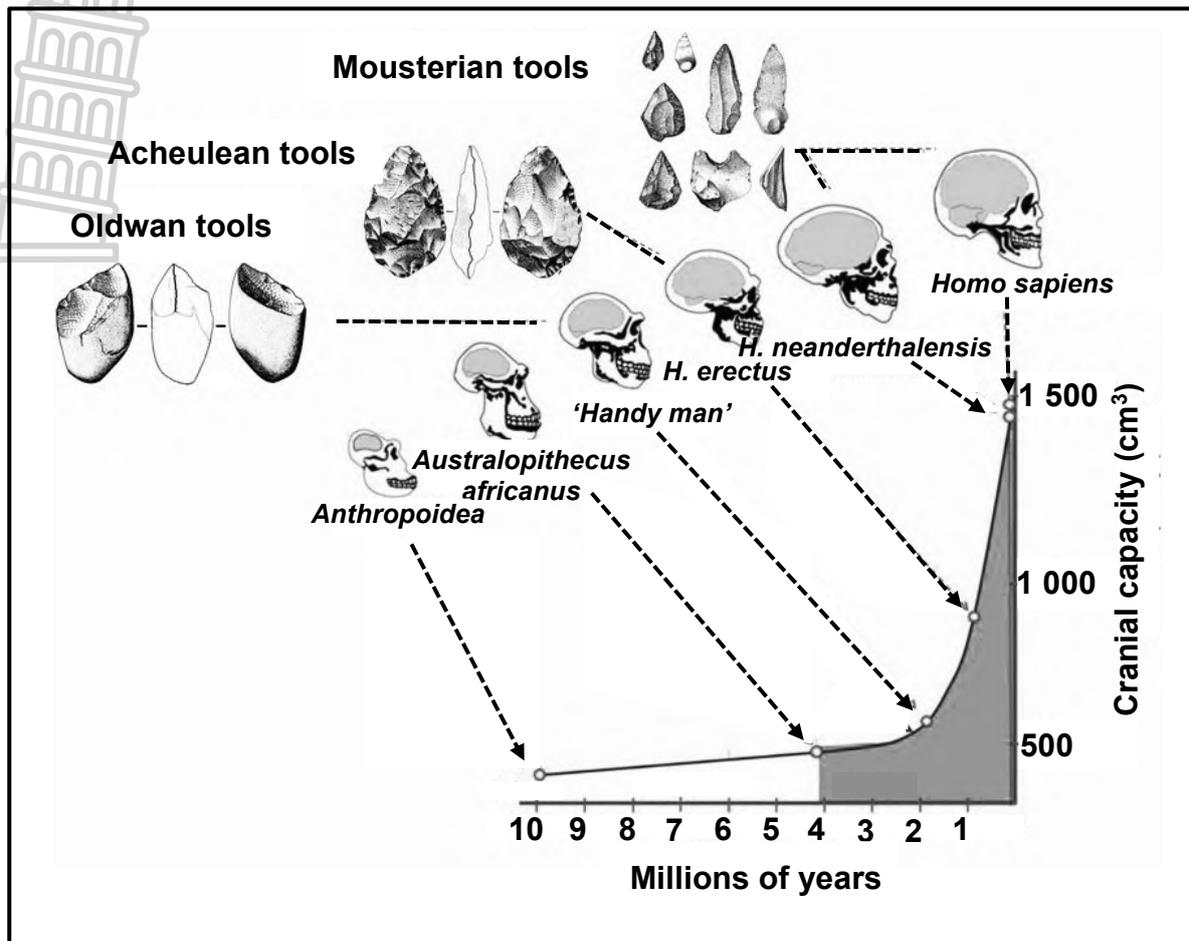
3.2.1 State TWO lines of evidence for human evolution in the diagram. (2)

3.2.2 Name TWO *Australopithecus africanus* species found in South Africa (2)

3.2.3 Identify the type of tools used by the species with the largest cranial capacity. (1)

3.2.4 How many genera are shown in the diagram above? (1)

3.2.5 Based on this diagram, the '*handy man*' species was in existence 1,8 million years ago.

   (a) Write the scientific name of the '*handy man*'. (1)

   (b) Provide a reason why the species named in QUESTION 3.2.5(a) is regarded as the '*handy man*' in human evolution. (1)

3.2.6 Explain why the evolution of a larger cranium in *homo sapiens* is associated with the development of tools. (3)

3.3 Lactose tolerance refers to the ability to digest lactose sugar into glucose and galactose. Lactose tolerant individuals do not experience discomfort after drinking milk or eating dairy products containing lactose. However, some individuals struggle to digest lactose due to the reduced production of the lactase enzyme and are classified as lactose intolerant. Such individuals cannot digest lactose.

Scientists investigated the influence of LCT gene mutations on lactose tolerance in African populations.

The scientists:

- Collected blood and DNA samples from 470 individuals. These individuals were from different ethnic groups in Kenya, Tanzania and Sudan.
- Divided the participants into two groups based on presence/absence of LCT gene mutations on chromosome 2.
- Gave the participants a lactose solution to consume daily for the duration of the investigation.
- Ensured participants ate the same diet during the investigation.
- Measured the blood glucose before and after consuming the lactose solution.

3.3.1 Identify the:

(a) Independent variable (1)

(b) Dependent variable (1)

3.3.2 Name the type of variation that exists in the ability to digest lactose in humans. (1)

3.3.3 State THREE ways in which the scientists ensured the reliability of the results in this investigation. (3)

3.3.4 State TWO factors that should have been kept constant when the lactose solution was consumed. (2)

3.3.5 Why did scientists measure the blood glucose levels before participants consumed lactose solution? (2)

3.3.6 Describe how the scientists could establish whether a genetic mutation has occurred on the LCT gene. (2)

3.4 Read the passage below.

> **ATLANTIC CODFISH EVOLVE TO ESCAPE HUMANS**
>
> Large scale over-fishing and slower maturation rates has led to the rapid decline in Atlantic codfish population. Humans often target fish with larger body sizes that can easily be caught by the nets with larger mesh they use when fishing. Over the years the Atlantic codfish has experienced mutations on the GHR genes that has resulted in a 30% reduction of body size and faster maturation rate.

3.4.1 According to the passage which human activity has resulted in a reduced population in the Atlantic codfish? (1)

3.4.2 Explain the effect of the GHR gene mutation on the survival chances of the Atlantic codfish. (2)

3.4.3 Use Darwin's theory of natural selection to explain the evolution of smaller body sizes and faster maturation rates in the Atlantic codfish. (7)

3.5 Read the passage about *Anadoluvius turkae* fossil.

> ***ANADOLUVIUS TURKAE* CHALLENGES EXISTING HYPOTHESIS ON THE ORIGIN OF HOMO SAPIENS**
>
> The discovery of the fossil remains of an 8,7 million year old *Anadoluvius turkae* by scientists in Turkey in Europe may change our understanding about the birthplace of hominins. The skull fossil of *Anadoluvius turkae* has transitional features similar to those found in African apes.

3.5.1 Name the hypothesis on human origins that is being challenged in this passage. (1)

3.5.2 State the hypothesis named in QUESTION 3.5.1. (2)

3.5.3 Describe THREE features of the skull of *Anadoluvius turkae* that were similar to African apes. (3)

3.5.4 What is the name of the 'birthplace' where most fossils of humankind were found? (1)

[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150

Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjhabela: Lefapha la Thuto

NATIONAL
SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2025

LIFE SCIENCES P2
MARKING GUIDELINE

MARKS: 150

This marking guideline consists of 11 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 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 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 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. Marking guideline 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 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.

4 **LIFE SCIENCES P2** **(EC/SEPTEMBER 2025)**

SECTION A

QUESTION 1

1.1   1.1.1   C ✓✓
      1.1.2   C ✓✓
      1.1.3   D ✓✓
      1.1.4   B ✓✓
      1.1.5   C ✓✓
      1.1.6   D ✓✓
      1.1.7   A ✓✓
      1.1.8   D ✓✓
      1.1.9   D ✓✓
      1.1.10 A ✓✓   (10 x 2)   (20)

1.2   1.2.1   DNA profile ✓
      1.2.2   Nucleoplasm ✓
      1.2.3   Incomplete ✓ dominance
      1.2.4   Geographic ✓ barrier
      1.2.5   Adaptation to different pollinators ✓
      1.2.6   Haemophilia ✓
      1.2.7   Random ✓ mating
      1.2.8   Punctuated equilibrium ✓   (8 x 1)   (8)

1.3   1.3.1   A only ✓✓
      1.3.2   A only ✓✓
      1.3.3   A only ✓✓   (3 x 2)   (6)

1.4   1.4.1   (a)   (diagram) 1 ✓   (1)

              (b)   (diagram) 2 ✓   (1)

      1.4.2   Crossing over ✓   (1)

      1.4.3   Prophase 1 ✓   (1)

      1.4.4   Somatic ✓   (1)

      1.4.5   (a)   Four ✓/4   (1)

              (b)   Two ✓/2   (1)

      1.4.6   Four ✓/4   (1)

Please turn over

1.5   1.5.1   Dihybrid ✓cross   (1)
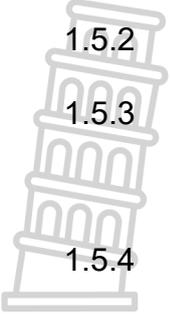
      1.5.2   DDLI ✓   (1)

      1.5.3   (a)   Dark feather colour with short tails ✓✓   (2)

            (b)   Complete ✓dominance   (1)

      1.5.4   (Parent) 1 ✓   (1)

      1.5.5   (Principle of) Segregation ✓
            (Principle of) Independent assortment ✓
            (Mark first TWO only)   (2)

TOTAL SECTION A: 50

QUESTION 2

2.1   2.1.1   (a)   DNA replication ✓   (1)

          (b)   Transcription ✓   (1)

      2.1.2   Nucleus ✓   (1)

      2.1.3   Interphase ✓   (1)

      2.1.4   -   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 ✓   (Any 5 x 1)   (5)

      2.1.5   -   DNA provides the genetic code for protein synthesis ✓
              -   that is copied to molecule R ✓/mRNA carries the coded message   (2)

      2.1.6   (a)   ACG AUG UCC ✓✓   (2)

          (b)   Threonine ✓✓   (2)

2.2   2.2.1   Chromosomal ✓ mutation   (1)

      2.2.2   (a)   44 ✓   (1)

          (b)   3 ✓/three   (1)

      2.2.3   XYY ✓   (1)

      2.2.4   A person with Down syndrome will have:

              -   THREE /3 chromosomes at position 21 ✓ and
              -   two/2 gonosomes ✓ instead of three
              -   In Jacob's syndrome there are TWO ✓/2 chromosomes at position
                  21   (3)

      2.2.5   -   Non-disjunction occurs ✓/ failure of chromatids to separate
              -   At position 23 ✓
              -   During anaphase II ✓
              -   A sperm cell has an extra chromosome ✓/2 chromosomes on
                  chromosome 23/ XY gonosome
              -   The abnormal sperm cell fertilises a normal ovum ✓/
              -   Resulting in a zygote with THREE ✓/3 gonosomes/XYY/47
                  chromosomes   (6)

Please turn over

2.3 2.3.1 (a) Female with blood group B ✓   (1)

(b) I^AI^B ✓   (1)

2.3.2 Two ✓/2   (1)

2.3.3 - If the child inherits allele I^A from Lisa and allele I^B from Jade ✓
- The child's blood group will be AB ✓
- If the child inherits allele **i** from each parents ✓
- The child's blood group will be O ✓   (Any 3)   (3)

2.3.4 **P₁**   Phenotype   Blood type AB   x Blood type O✓
Genotype I^AI^B ✓   x   ii ✓

Meiosis

G/gametes I^A , I^B x   i ,   i ✓

Fertilisation

F₁   Genotype I^Ai ; I^Ai ; I^Bi ; I^Bi ✓

Phenotype   2 Blood group **A**   : 2 Blood group **B**

They have a 0**%** ✓*chance of having a child with blood group **O**.

OR

P₁   Phenotype   Blood group AB   x Blood type O ✓
male/dad   female/mother
Genotype I^Ai ✓   x I^Bi ✓

Meiosis

G/gametes I^A ,   i   x I^B ,   i ✓

Fertilisation
F₁

Gametes	I^A	I^B
i	I^Ai	I^Bi
i	I^Ai	I^Bi
Correct genotypes ✓		

Phenotype   2 Blood group **A** : 2 Blood group **B**

They have a 0% ✓*chance of having a child with blood group O.

P₁ and F₁ ✓
Meiosis and fertilisation ✓   **Any 5 + *1 Compulsory**   (6)

2.4 2.4.1 (a) Ovum ✓   (1)

           (b) Uterus ✓   (1)

     2.4.2 $\frac{63,3}{100}$ ✓ x 395 ✓ = 250 ✓ cattle cloned   (3)

     2.4.3 - More cattle will have similar alleles ✓/ same genotype for all
              characteristics
            - Variation will decrease ✓   (2)

     2.4.4 - More muscle/meat production ✓
            - High milk production ✓/quality
            - Better meat quality ✓
            - Resistance to disease ✓   (Any 3 x 1)   (3)
   **[50]**

QUESTION 3

3.1   3.1.1   Sub-Sahara Africa ✓   (1)

      3.1.2   -   Under/lack of reporting ✓ of cases
              -   Lack/poor testing facilities ✓
              (Mark first ONE only)   (Any 1)   (1)

      3.1.3   -   Females need two recessive alleles on each X-chromosome to be
                  colour-blind ✓
              -   If there is a dominant allele on the X-chromosome it will mask the
                  expression of a recessive allele ✓ on the other X-chromosome in a
                  female who is not colour blind.   (2)

      3.1.4

% Prevalence of males with colour-blindness in African and Asian regions
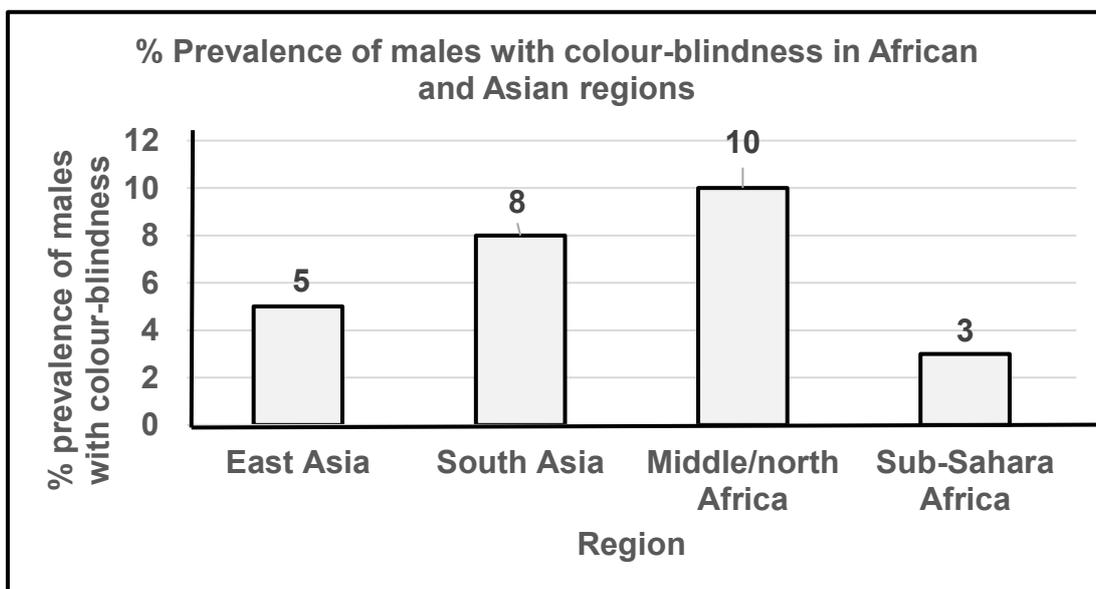
Guideline for assessing the graph

CRITERIA		ELABORATION	MARK
Type of graph	(T)	Bar graph drawn	1
Caption of graph	(C)	Both variables included	1
Axes labels	(L)	X- and Y-axis correctly labelled with units	1
Scale for X- and Y-axis	(S)	- Equal space and width of bars for X-axis - Correct scale for Y-axis	1
Plotting of co-ordinates	(P)	- 1 to 3 required co-ordinates plotted correctly - All 8 co-ordinates plotted correctly - All 4 required co-ordinates plotted correctly.	1 1 2

(6)

Histogram or line graph drawn
-   Lose marks for type of graph and for scale

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 and scale
-   Check that the plotting is correct for the given labels

3.2   3.2.1   - Cultural ✓ evidence
            - Fossil ✓evidence
            (Mark first TWO only) (2)

      3.2.2   - Taung child ✓
            - Mrs Ples ✓
            - Little foot ✓
            (Mark first TWO only) (Any 2 x 1)   (2)

      3.2.3   Mousterian tools ✓ (1)

      3.2.4   Three ✓/3 (1)

      3.2.5   (a)   *Homo habilis* ✓ (1)

            (b)   First to use tools ✓ (1)

      3.2.6   - Increased brain size ✓led to
            - increased intelligence✓leading to
            - the development of complex tools ✓ (3)

3.3   3.3.1   (a)   LCT gene mutation ✓ (1)

            (b)   Lactose tolerance ✓ (1)

      3.3.2   Discontinuous ✓ variation (1)

      3.3.3   - 470 individuals used ✓
            - Individuals were from different ethnic groups ✓
            - Individuals were from three different African countries ✓/Kenya, Tanzania and Sudan (3)

      3.3.4   - Amount ✓ of lactose solution
            - Concentration ✓ of lactose solution
            (Mark first TWO only) (2)

      3.3.5   - In order to establish the baseline ✓
            - So that increases in blood glucose levels show lactase activity ✓/ indicate lactose tolerance (2)

      3.3.6   - Sequenced the DNA of the participants on chromosome 2 ✓ / Determine the sequence of nucleotides on DNA
            - To identify mutations on the LCT gene ✓/ Compare to normal DNA/ lactose intolerant individuals. (2)

3.4   3.4.1   Large scale over-fishing ✓   (1)

3.4.2
- The mutation was useful ✓/ beneficial/resulted in a reduced body size that is not targeted for fishing
- Increasing the survival chances ✓ of the Atlantic codfish   (2)

3.4.3
- There was genetic variation in the codfish ✓ population
- Some had experienced mutations on the GHR genes that resulted in smaller body size and faster maturations rates others did not ✓
- When over-fishing occurred ✓
- Codfish without the mutation on the GHR genes/larger body sizes and slower maturations rates died ✓
- Those with the mutation on the GHR genes/smaller body sizes and faster maturation rates survived ✓
- and reproduced ✓
- passing on the allele with mutations on the GHR genes/smaller body size and faster maturation rates to their offspring ✓
- the next generation has a higher proportion of codfish with mutations on the GHR genes ✓/smaller body sizes and faster maturation rates   (Any 7)   (7)

3.5   3.5.1   *Out of Africa* ✓ *hypothesis*   (1)

3.5.2
- Modern humans originated in Africa ✓ and then
- Migrated to other continents ✓/rest of the world   (2)

3.5.3
- Smaller cranium size ✓
- Foramen magnum at a more backward position ✓ on the skull
- Prominent/large brow-ridges ✓
- Protruding jaws ✓/prognathous
- Rectangular palate ✓
  (Mark first THREE only)   (Any 3)   (3)

3.5.4   Cradle of Humankind ✓   (1)

     [50]

TOTAL SECTION B: **100**
GRAND TOTAL: **150**