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.

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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.

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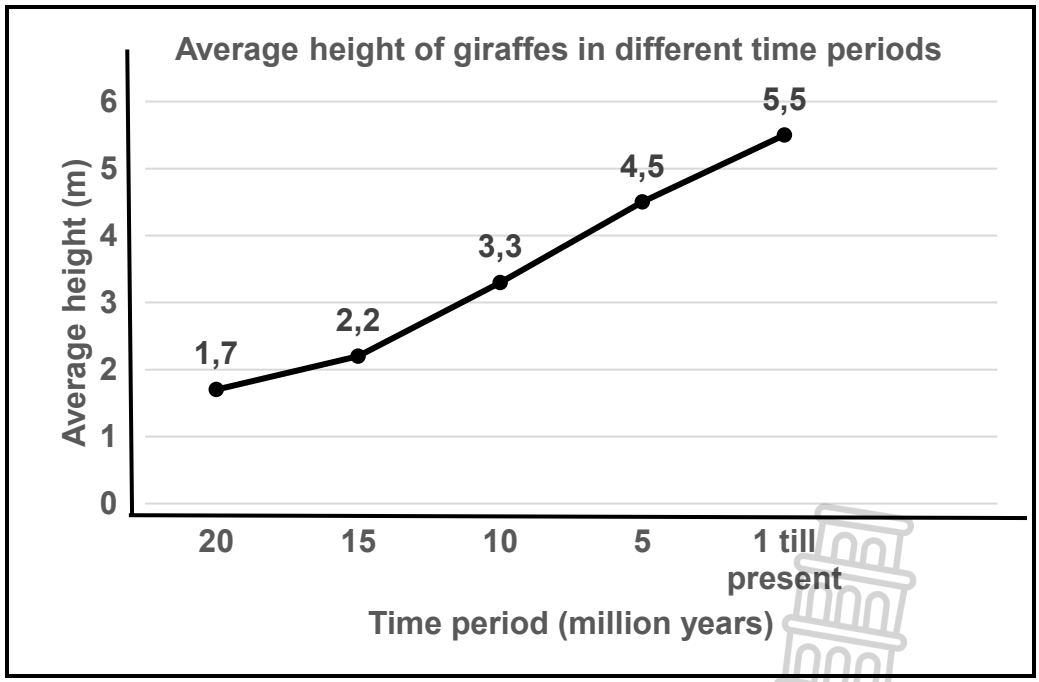
1.1.6 The scientists who played a role in the discovery of the DNA molecule.

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%

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)

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.

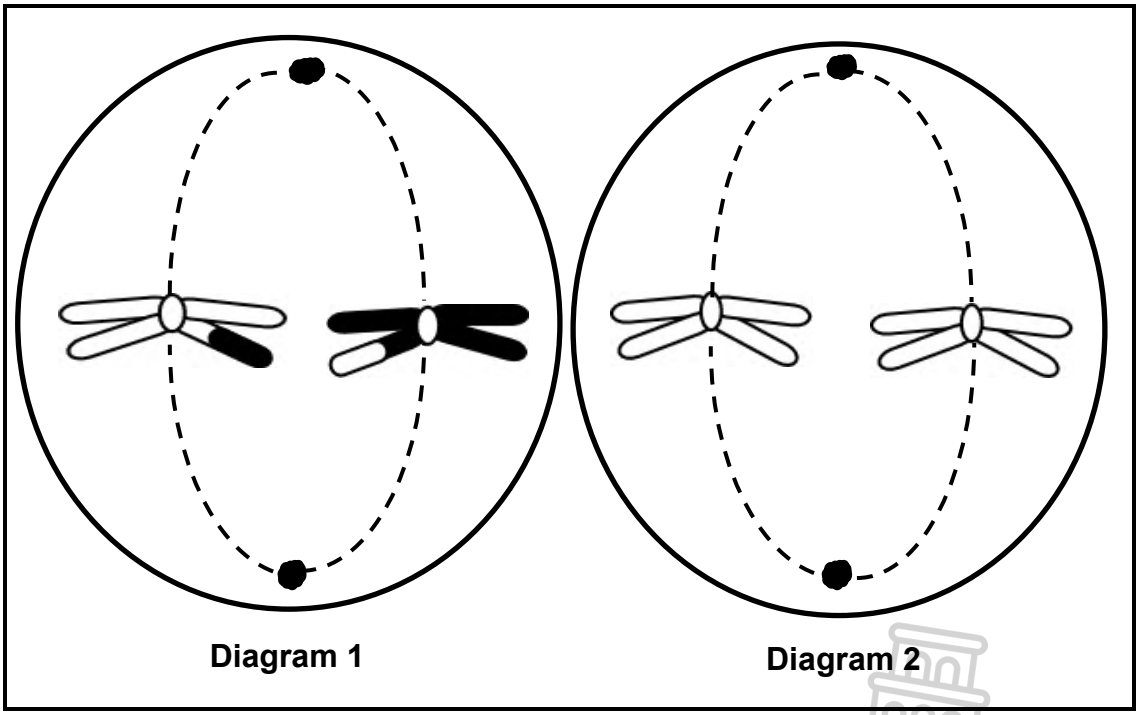


Diagram 1 **Diagram 2**

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)

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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)

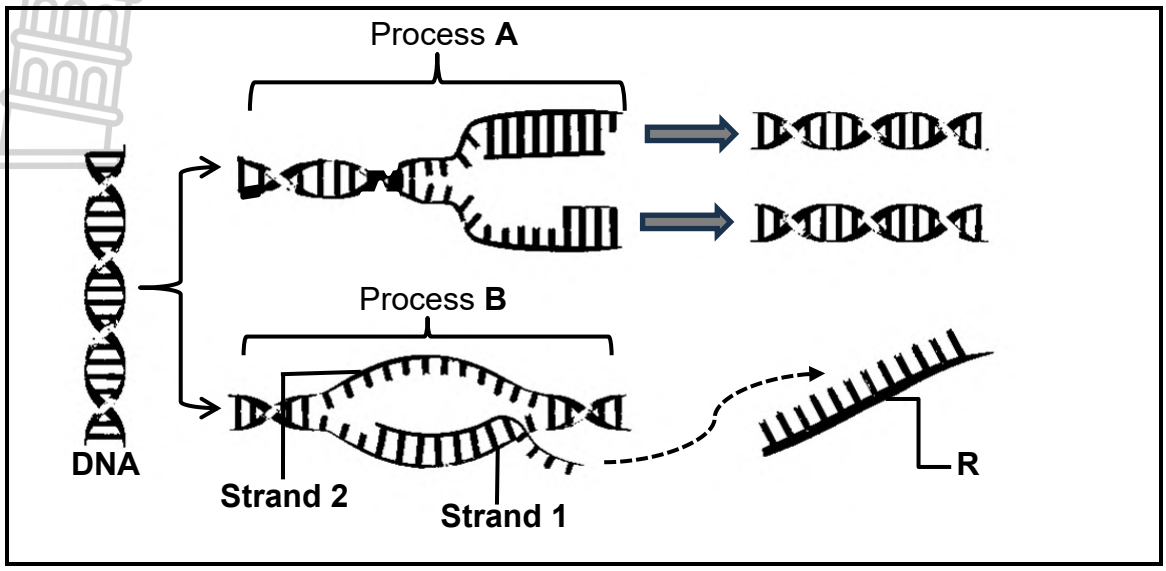
TOTAL SECTION A: 50

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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**.

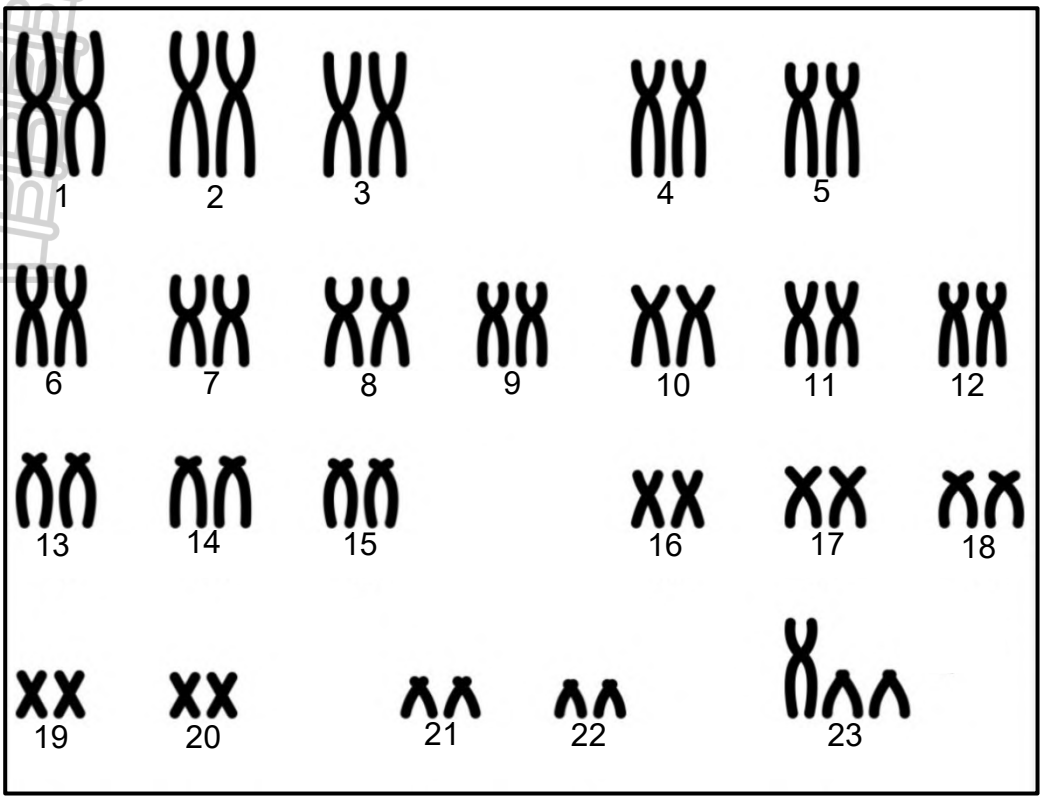
Base triplet	DNA nucleotides on strand 1	Amino acid
1	TGC	Cystine
2	TAC	Tyrosine
3	AGG	Arginine
4	ACG	Threonine

(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)

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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)

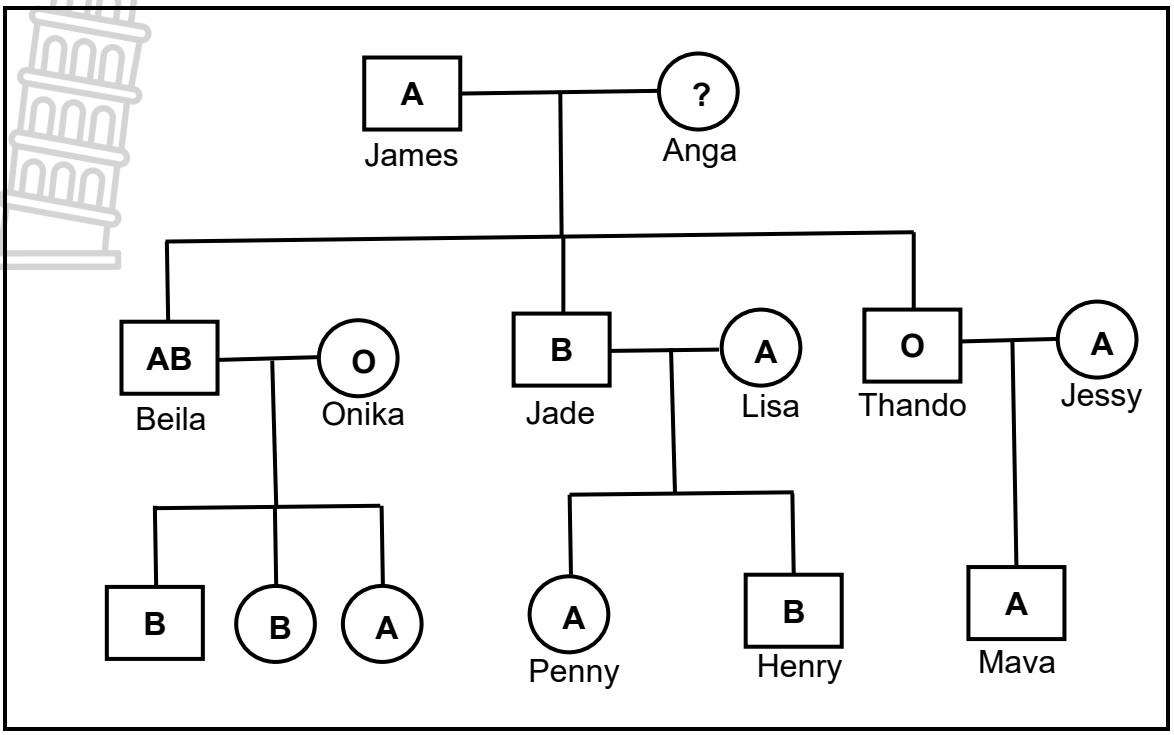
(b) Gonosomes (1)

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)

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)

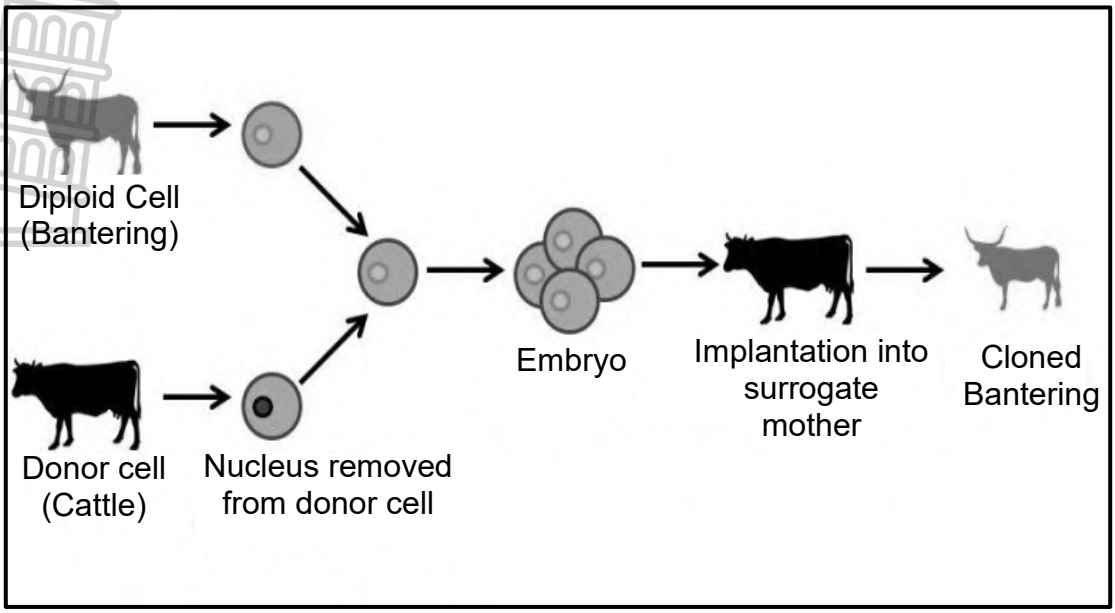
(b) Genotype of the individual that displays co-dominance (1)

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)

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)

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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)

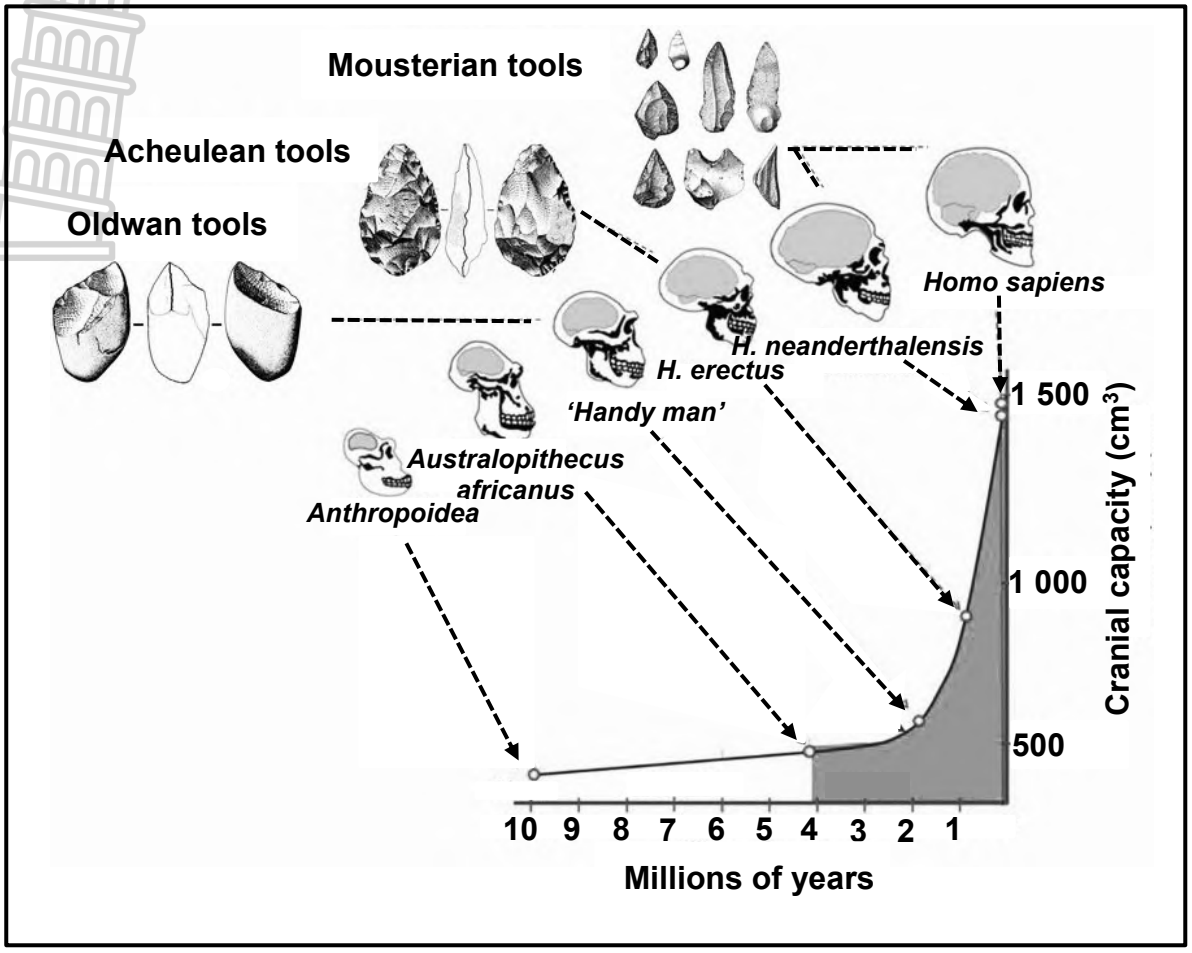
3.1.3 The prevalence of colour-blindness in females is 0.5% globally.

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)

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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)

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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)

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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)

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TOTAL SECTION B: 100
GRAND TOTAL: 150

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