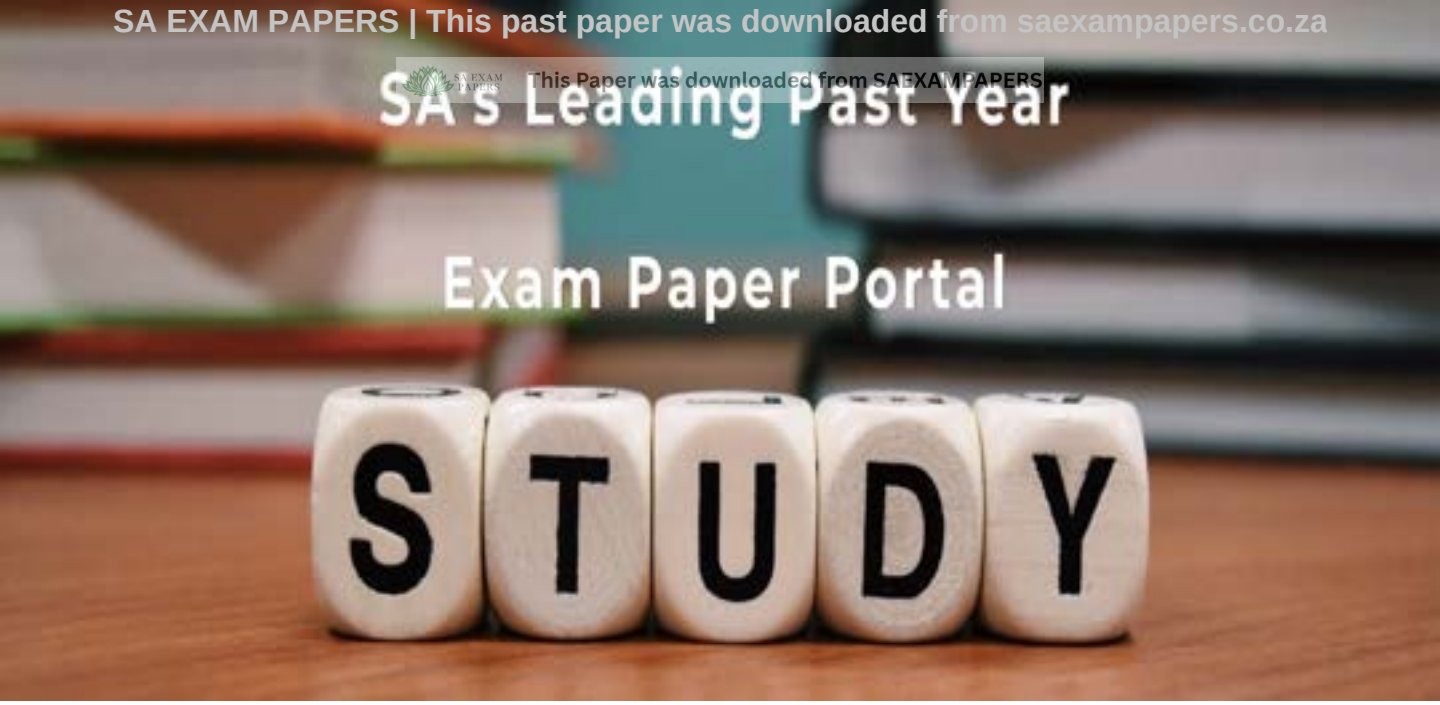


education

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

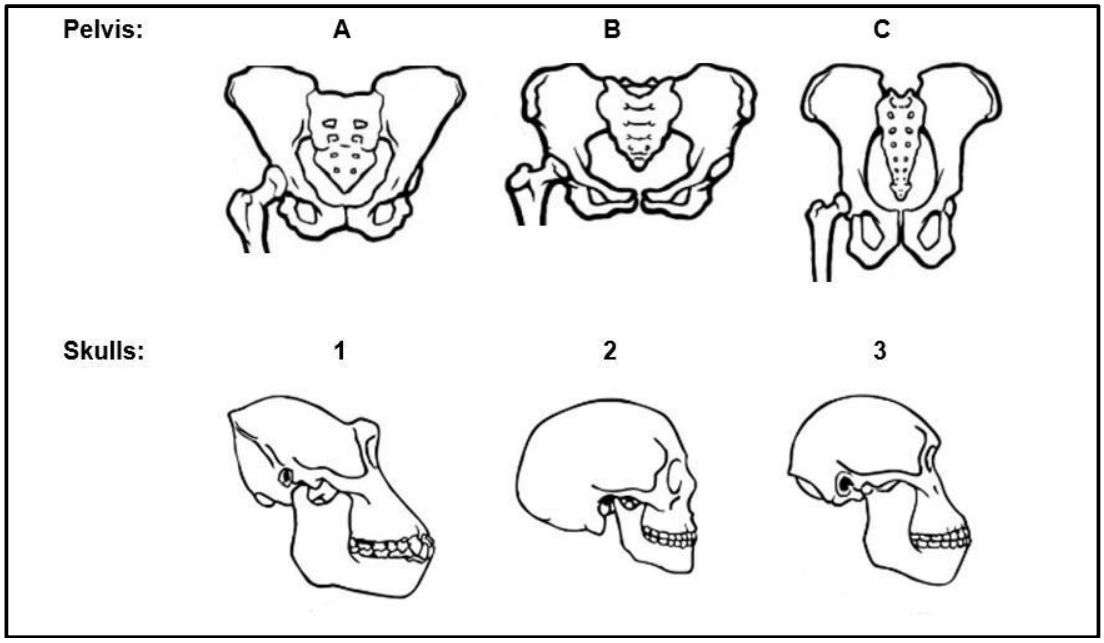
1.1.5 The following statements are sources of variation.

(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 phenotypical 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:

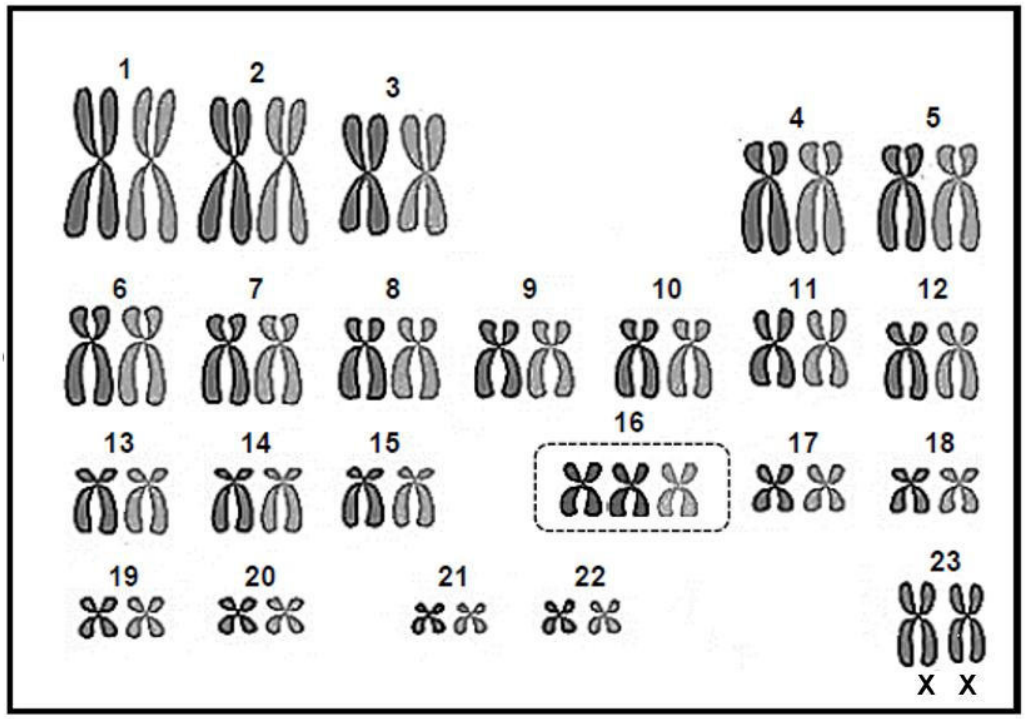
	PELVIS A	PELVIS B	PELVIS C
A	Skull 1	Skull 2	Skull 3
B	Skull 1	Skull 3	Skull 2
C	Skull 3	Skull 2	Skull 1
D	Skull 2	Skull 3	Skull 1

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.



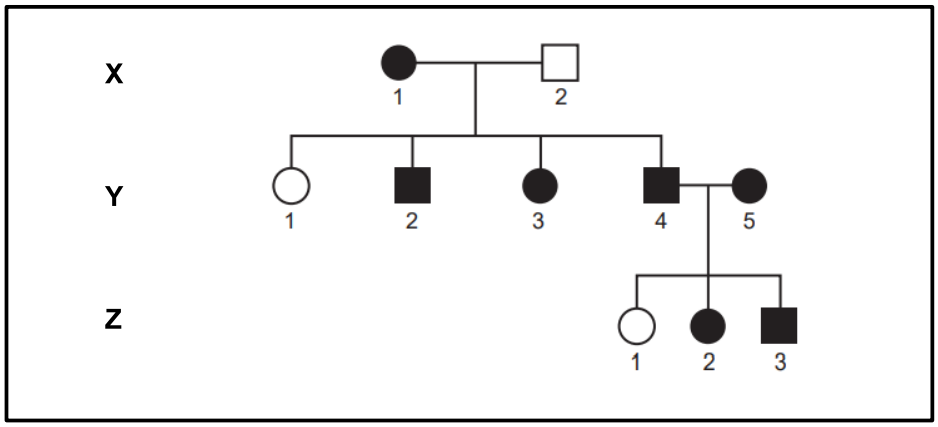
1.1.8 The chromosomal composition of this cell is ...

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

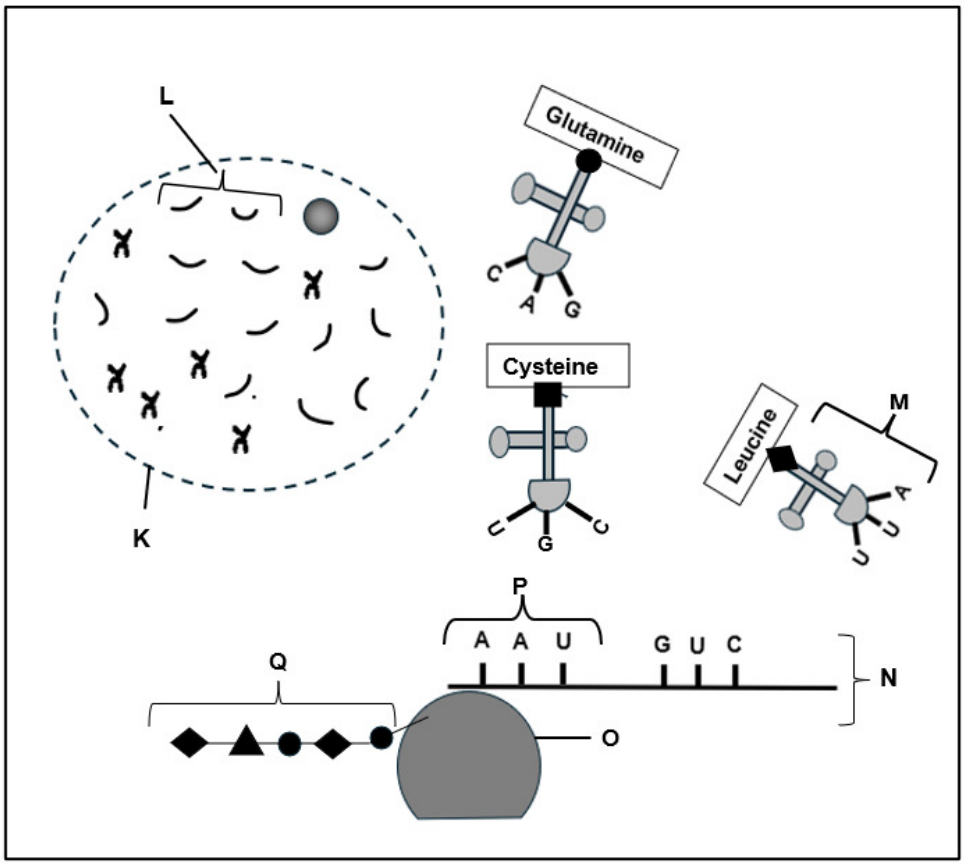
1.2.10 The theory of evolution proposes that the offspring will inherit the alleles for favourable characteristics **(10)**

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:

a) Structure **K** (1)
b) Molecule **Q** (1)

1.4.2 Give the LETTER of the:

a) Organelle where translation took place (1)
b) Tangled network of DNA (1)
c) Hair-pin-shaped nuclei 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	*Australopithecus africanus*	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)

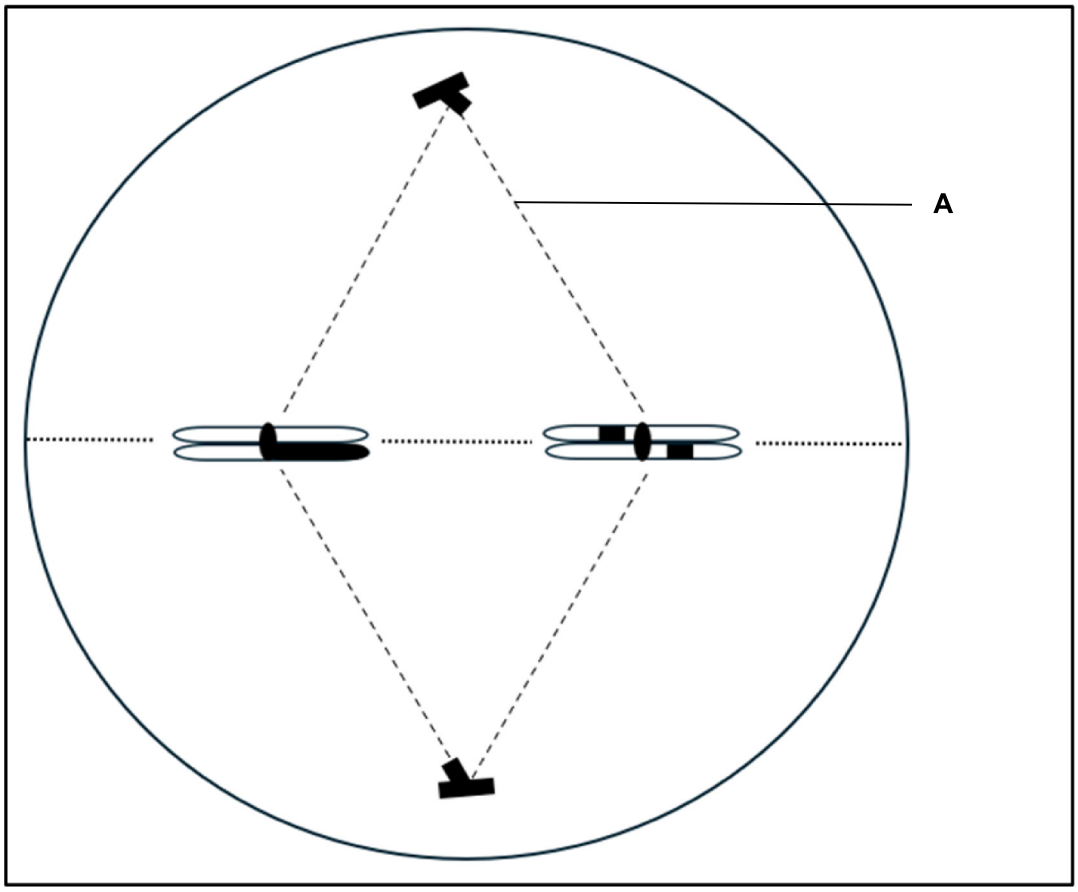
2.1.2 Explain how DNA profiling was used to identify some of the tsunami victims. (4)

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.

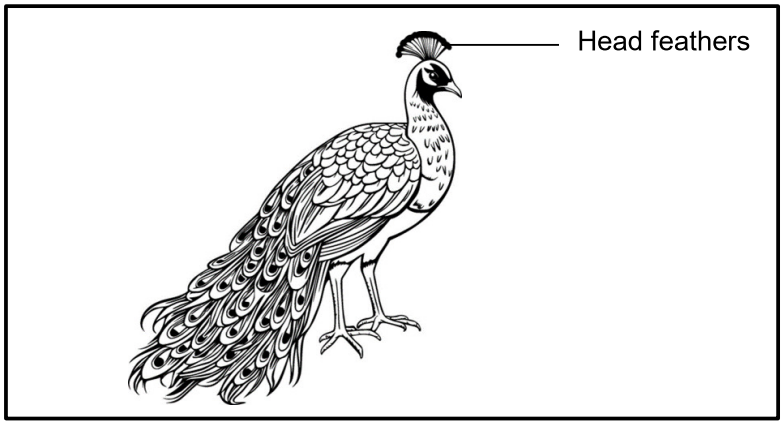
2.3.1 Which parent determines the sex of a child? (1)

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.

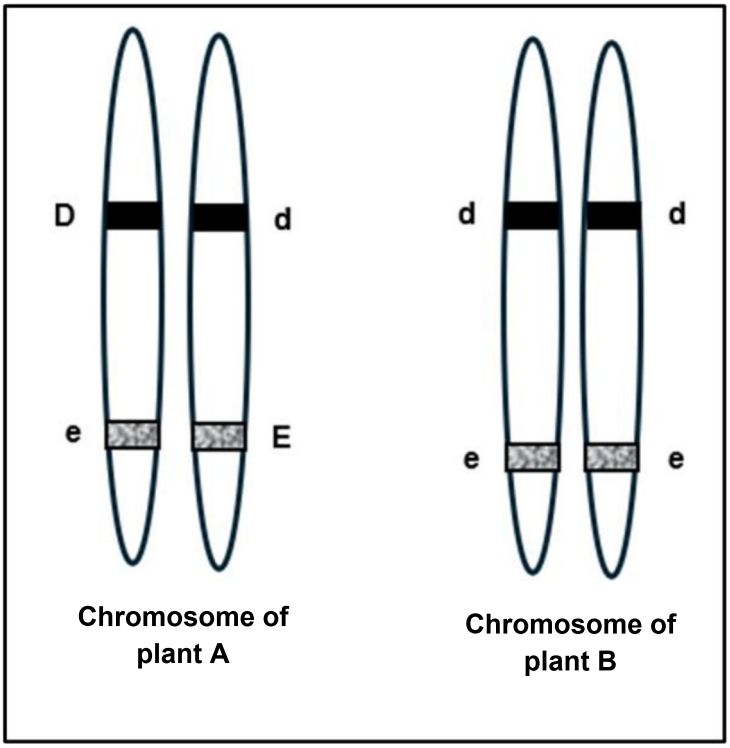
The inheritance of head feathers is sex-linked, and the gene for head feather colour in a bird is only found on the Z chromosome. The W chromosome does not contain a copy of this gene. Red head feathers (**R**) are dominant over black head feathers (**r**).



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:

a) Phenotype of plant **A**. (2)

b) Genotype of plant **B**. (2)

c) 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.

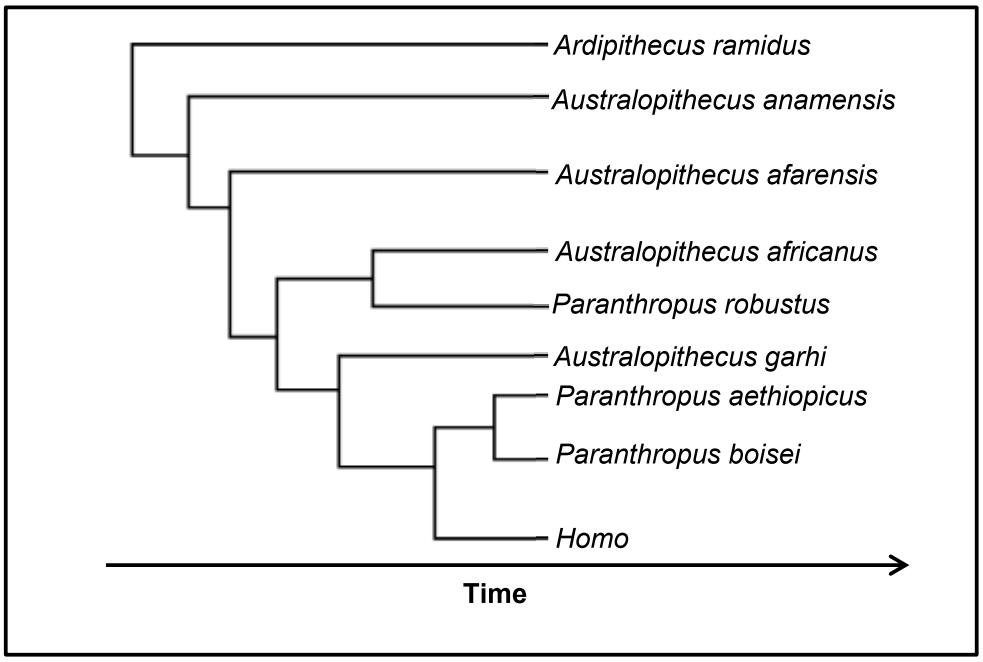
3.1.1 Name the biotechnology process used to make an identical copy of the Bucardo. (1)

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