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Basic Education
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SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

LIFE SCIENCES P2

MAY/JUNE 2024

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 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 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 1.1.9) in the ANSWER BOOK, e.g. 1.1.10 D.

- 1.1.1 Which female scientist took X-rays of the DNA molecule and concluded that DNA is helix-shaped?

A Watson
B Franklin
C Crick
D Wilkins

- 1.1.2 A cell with 14 chromosomes undergoes meiosis.

What is the number of chromatids in this cell at the beginning of meiosis?

A 7
B 14
C 28
D 56

- 1.1.3 In the inheritance of blood groups there are ...

A two phenotypes controlled by three alleles.
B three phenotypes controlled by two alleles.
C four phenotypes controlled by three alleles.
D four phenotypes controlled by two alleles.

- 1.1.4 The following statements relate to cell division:

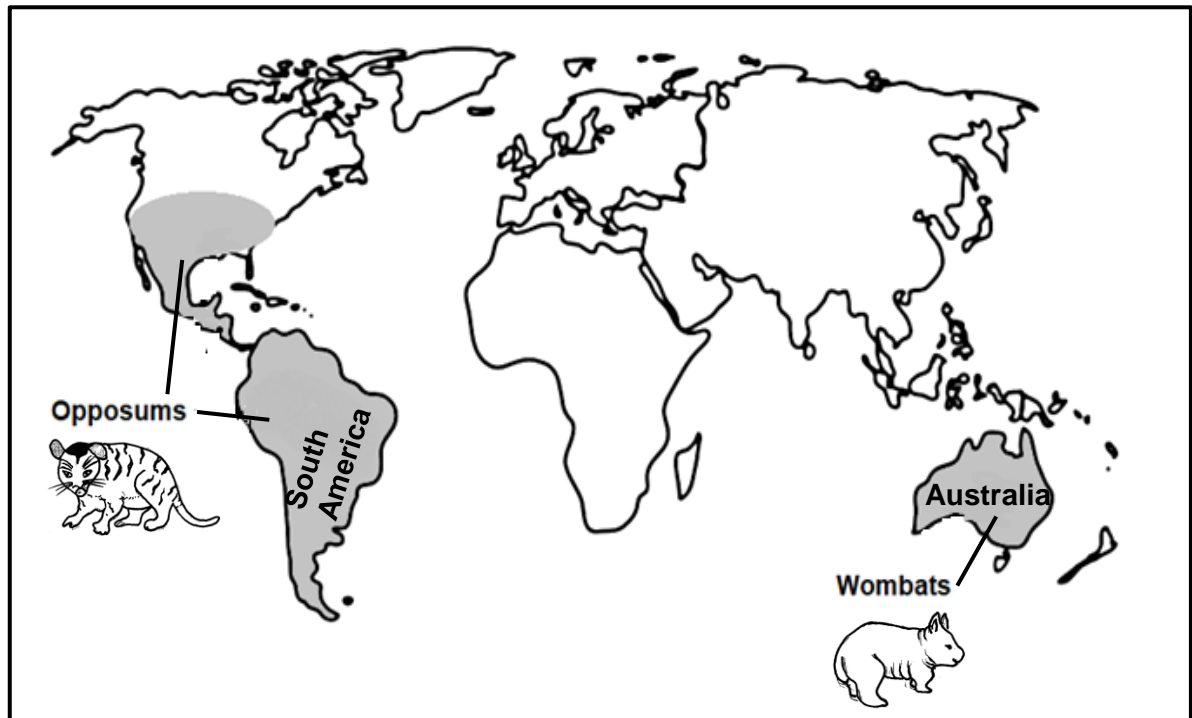
(i) Crossing over occurs
(ii) Contributes to genetic variation in a population
(iii) Produces cells with a diploid number of chromosomes
(iv) Produces somatic cells only

Which ONE of the following combinations of statements refer to meiosis?

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

- 1.1.5 The opossums and wombats are believed to have originated from a common ancestor.

The shaded parts of the diagram below show the distribution of these species.



The type of evidence for evolution that is represented in the diagram is ...

- A biogeography.
 - B modification by descent.
 - C genetics.
 - D cultural.
- 1.1.6 A plant with yellow (y) and round (R) peas is crossed with a plant with green (Y) and wrinkled (r) peas.

Which ONE of the following are the possible genotypes of the parents (P_1)?

- A yyRR x YYRr
- B YyRR x yyrr
- C Yyrr x YYRR
- D yyRR x YYrr

1.1.7 A segment of DNA contains:

- 31% of adenine in strand 1
- 12% of cytosine in strand 2
- 27% of guanine in strand 2

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

- A 31% of adenine in strand 2
- B 12% of cytosine in strand 1
- C 31% of thymine in strand 2
- D 27% of cytosine in strand 2

1.1.8 Two people each gave four descriptions about themselves.

	PERSON 1	PERSON 2
P	I can roll my tongue.	I cannot roll my tongue.
Q	I am 150 cm tall.	I am 153 cm tall.
R	I have unattached earlobes.	I have attached earlobes.
S	My blood group is A.	My blood group is AB.

Which ONE of the following combinations are examples of discontinuous variation?

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

1.1.9 The phase in meiosis where chromatids are pulled towards poles is ...

- A anaphase I
- B telophase I
- C metaphase II
- D anaphase II

(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 1.2.8) in the ANSWER BOOK.

1.2.1 A section of a DNA molecule that codes for a specific characteristic

1.2.2 A pattern of black bars resulting from DNA analysis

1.2.3 Evolution characterised by long periods of no change alternating with short periods of rapid change

1.2.4 The production of a genetically identical copy of an organism using biotechnology

1.2.5 Undifferentiated cells in animals that have the potential to become any type of tissue

1.2.6 A genetic disorder that results in a person who cannot distinguish between the colours red and green

1.2.7 The part of the plant where the male gametes are produced

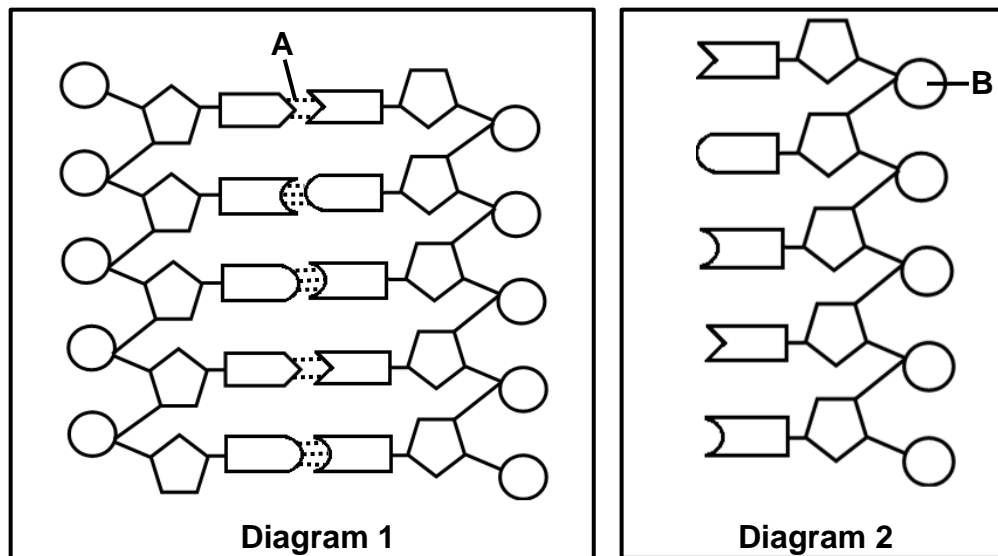
1.2.8 The structure that joins two chromatids together (8 x 1) **(8)**

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	The type of dominance in which neither of the two alleles is dominant over each other, resulting in an offspring with an intermediate phenotype	A:	Complete dominance
		B:	Co-dominance
1.3.2	The point where two chromatids overlap during crossing over	A:	Chiasma
		B:	Locus
1.3.3	The scientist who proposed the law of segregation	A:	Darwin
		B:	Lamarck

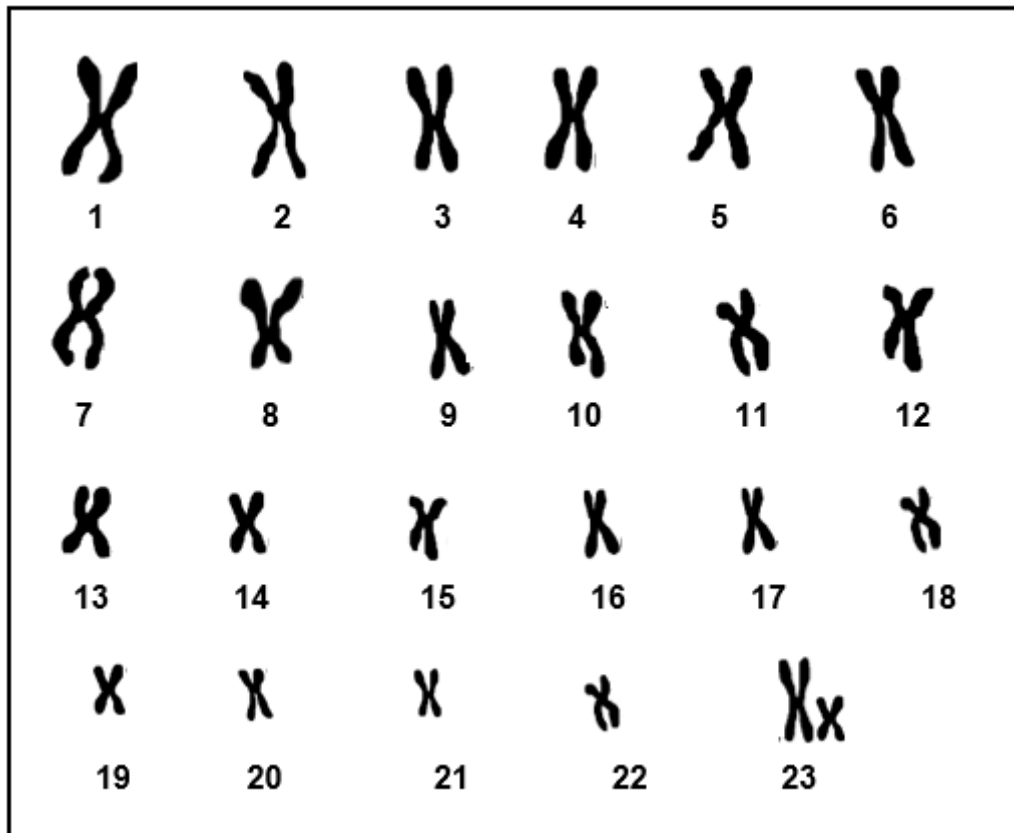
(3 x 2) **(6)**

1.4 The diagrams below represent two types of nucleic acids.



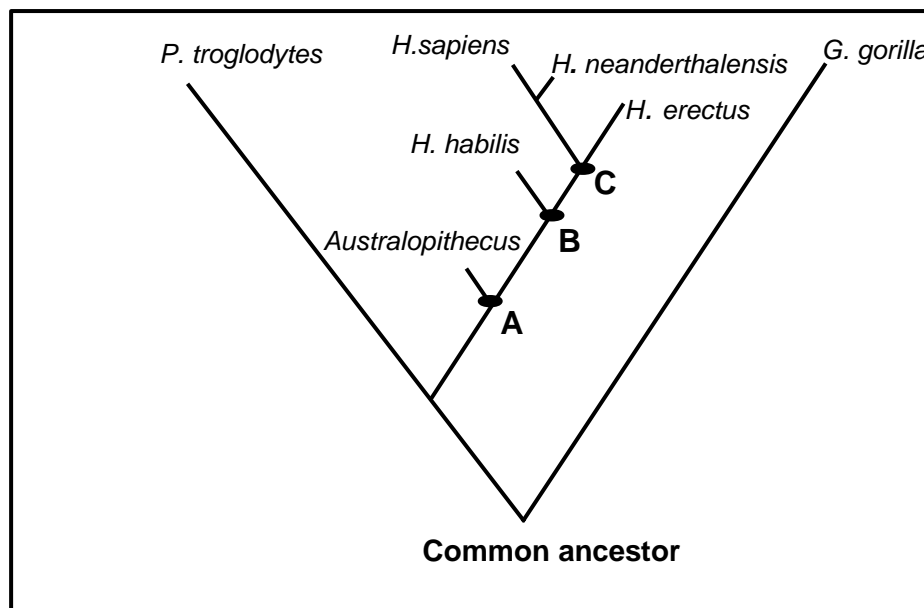
- 1.4.1 Identify the nucleic acid shown in diagram 1. (1)
- 1.4.2 Identify:
- (a) **A** (1)
- (b) **B** (1)
- 1.4.3 Name the type of sugar found in the nucleic acid represented in diagram 2. (1)
- 1.4.4 Which diagram (1 or 2) represents a nucleic acid that is used for:
- (a) Tracing of human ancestry (1)
- (b) Paternity testing (1)
- (6)**

1.5 The diagram below shows the karyotype of a gamete of an individual.



- 1.5.1 Name the type of mutation that occurred during the production of this gamete. (1)
- 1.5.2 What type of gamete is represented in the karyotype? (1)
- 1.5.3 In this gamete, give the number of:
- (a) Autosomes (1)
 - (b) Gonosomes (1)
- 1.5.4 This gamete fuses with a normal gamete.
- Using X and Y representation, write the sex chromosomes of the offspring. (2)
(6)

- 1.6 The diagram below shows the evolutionary relationship between different species.

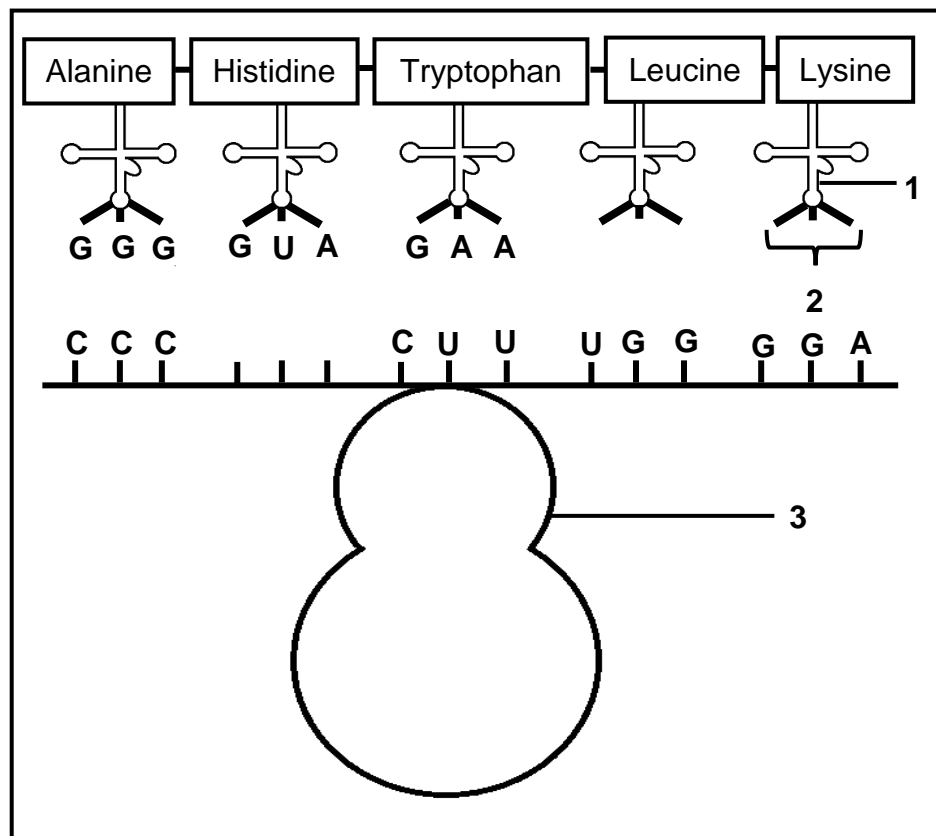


- 1.6.1 Identify the type of diagram shown above. (1)
- 1.6.2 Give the:
- (a) Genus that gave rise to the *Australopithecus* at **A** (1)
- (b) LETTER that represents the most recent common ancestor for both *H. sapiens* and *H. erectus* (1)
- 1.6.3 Name TWO species that existed at the same time as *H. erectus*. (2)
- 1.6.4 Give ONE example of the fossil of *Australopithecus africanus* that was found in South Africa. (1)
- (6)**

TOTAL SECTION A: 50

SECTION B**QUESTION 2**

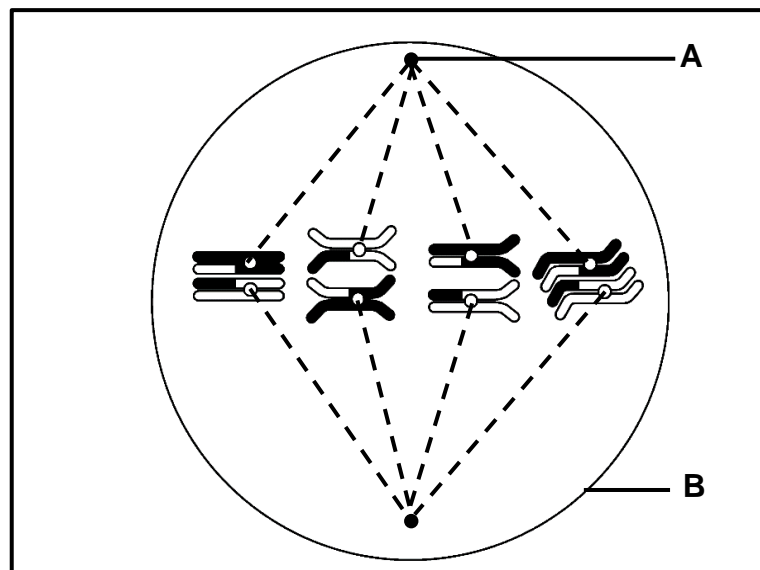
- 2.1 The diagram below represents a stage during the synthesis of a certain protein.



- 2.1.1 Identify organelle **3**. (1)
- 2.1.2 Describe the role of molecule **1** during this stage of protein synthesis. (2)
- 2.1.3 Give the sequence of nitrogenous bases: (1)
- (a) At **2** (1)
- (b) On the DNA molecule that coded for histidine (2)
- 2.1.4 During the synthesis of the same protein, there was a change in the amino acid sequence because alanine was replaced by tryptophan. (3)
- Explain the possible reason for this. (9)

2.2 Describe *transcription*. (6)

2.3 The diagram below represents metaphase I of meiosis.

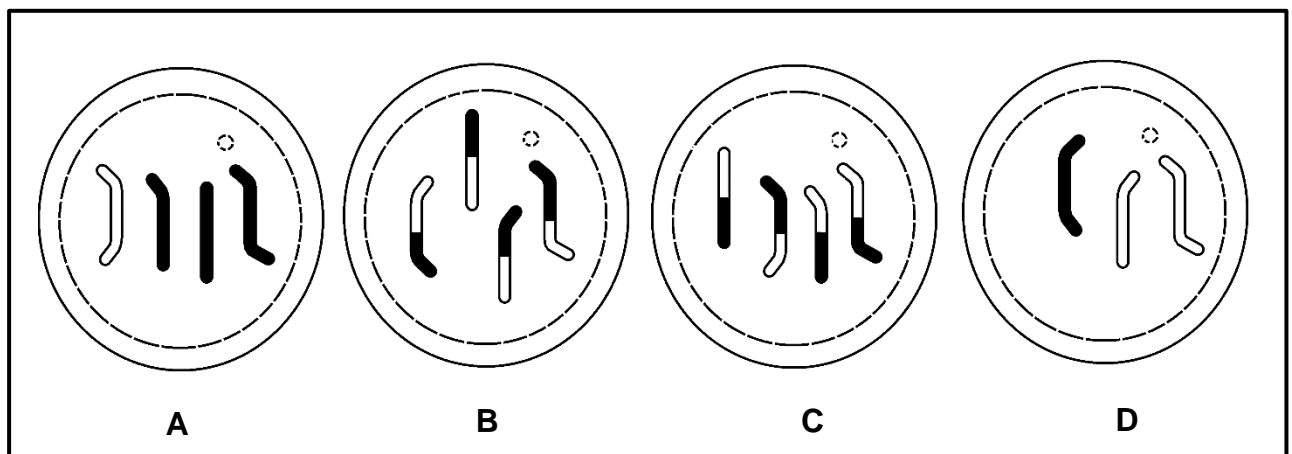


2.3.1 Identify part **B**. (1)

2.3.2 State ONE function of part **A**. (1)

2.3.3 Explain the contribution of metaphase I to natural selection. (6)

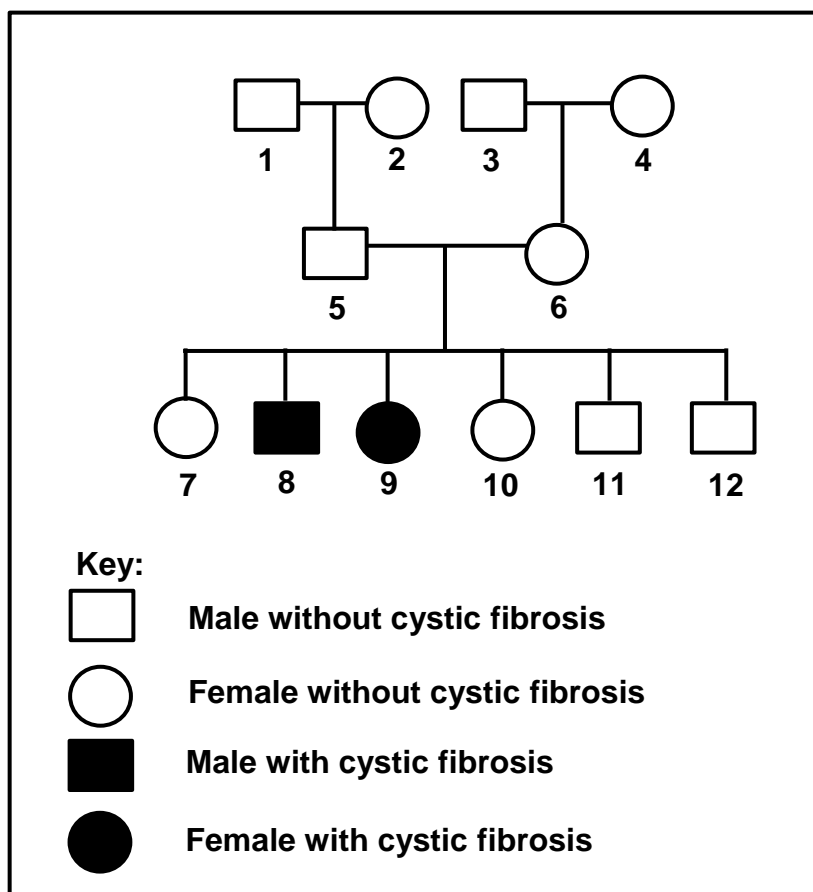
The diagram below shows four possible daughter cells formed at the end of this meiosis.



2.3.4 Draw cell **D**, including the missing 4th chromosome. (3)
(11)

2.4 Cystic fibrosis is a genetic disorder caused by a recessive allele (**b**).

The pedigree diagram below shows the inheritance of cystic fibrosis in a certain family.



- 2.4.1 How many generations are represented in the diagram above? (1)
- 2.4.2 Give the genotype of individual 9. (1)
- 2.4.3 Explain why both individuals 5 and 6 must be heterozygous for cystic fibrosis. (4)
- 2.4.4 Using the letters **B** and **b**, do a genetic cross to show the inheritance of cystic fibrosis when heterozygous parents are crossed. (6)
- (12)**

2.5 Bt corn is a crop that has been genetically modified to be insect-resistant.

The table below shows the percentage of land used to grow Bt corn and the amount of insecticide used in a certain country between 1995 and 2010.

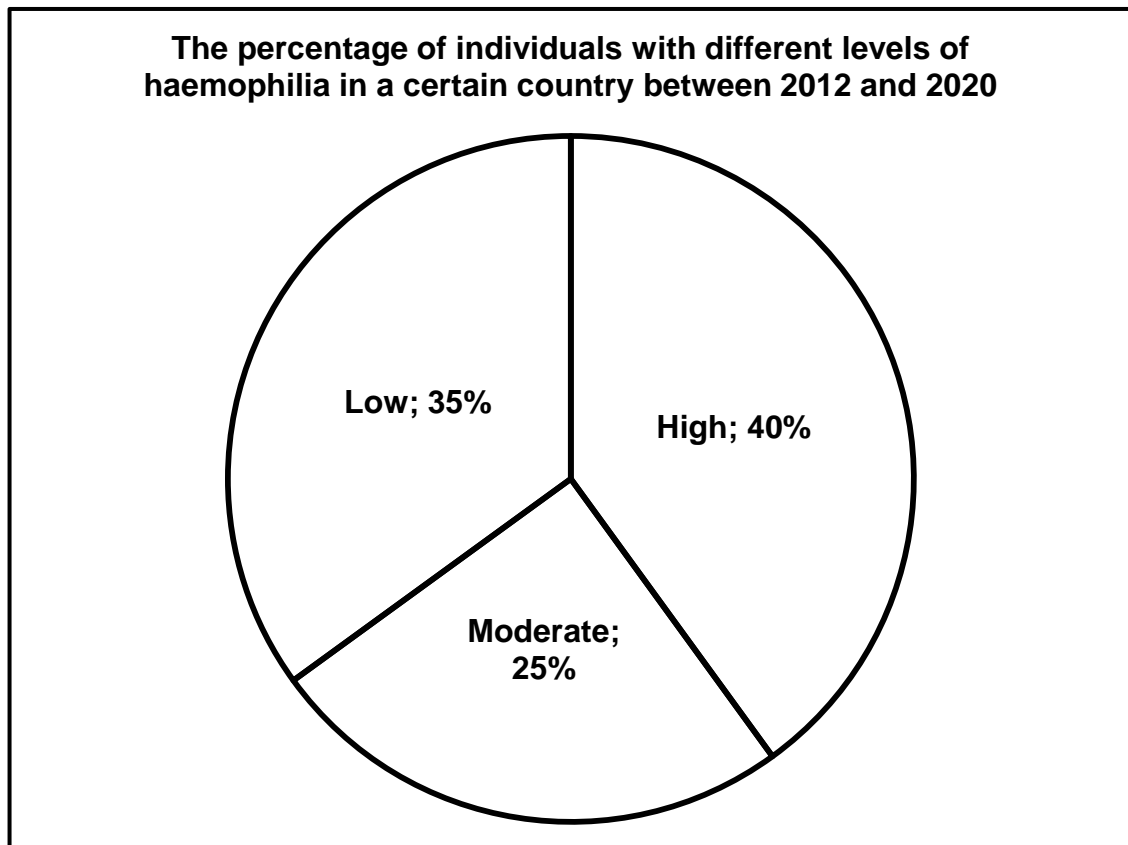
Year	Land used to grow Bt corn (%)	Amount of insecticide used (kg per hectare)
1995	0	0,2
2000	20	0,13
2005	40	0,05
2010	60	0,01

- 2.5.1 Describe how genetic engineering of Bt corn was done. (2)
- 2.5.2 Describe the relationship between the land used to grow Bt corn and the amount of insecticide used. (2)
- 2.5.3 State TWO other plant characteristics that are genetically engineered to increase food security. (2)
- 2.5.4 Draw a bar graph to represent the percentage of land used to grow Bt corn from 1995 to 2010. (6)
- (12)**
- [50]**

QUESTION 3

- 3.1 In a certain country, 25 000 individuals were suffering from haemophilia between 2012 and 2020. Haemophilia is a genetic disorder that is caused by a mutation.

The pie chart below shows the percentage of individuals with different levels of haemophilia in this country.

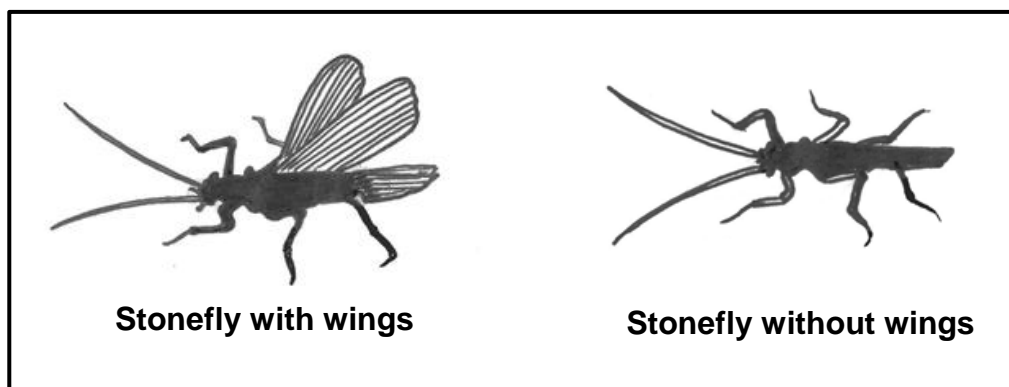


- 3.1.1 Explain the effect of this mutation on an individual. (2)
- 3.1.2 Calculate the number of individuals who were moderately affected by haemophilia in this country. Show ALL working. (2)
- 3.1.3 Explain why it would be expected that most of the individuals affected by haemophilia will be males. (3)
(7)

- 3.2 Insects on islands without trees are likely to be wingless because flying is dangerous for them in an area with strong winds.

A certain island was once covered with tall trees. Over the years, there has been deforestation in some areas of the island. On this island, insects called stoneflies, have undergone natural selection. Some have wings and some do not have wings, depending on the area where they are found.

The diagram below shows stoneflies with and without wings.



Scientists wanted to determine the relationship between the presence of tall trees and the wings on the stoneflies.

- They selected six locations, of which three had tall trees and three were without trees.
- Using a specialised net, they collected thousands of stoneflies in each location.
- The samples were labelled according to the area of collection.
- These samples were all collected in the morning during summer.
- The number of stoneflies with wings and without wings at each location was counted and recorded.

3.2.1 Identify the:

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

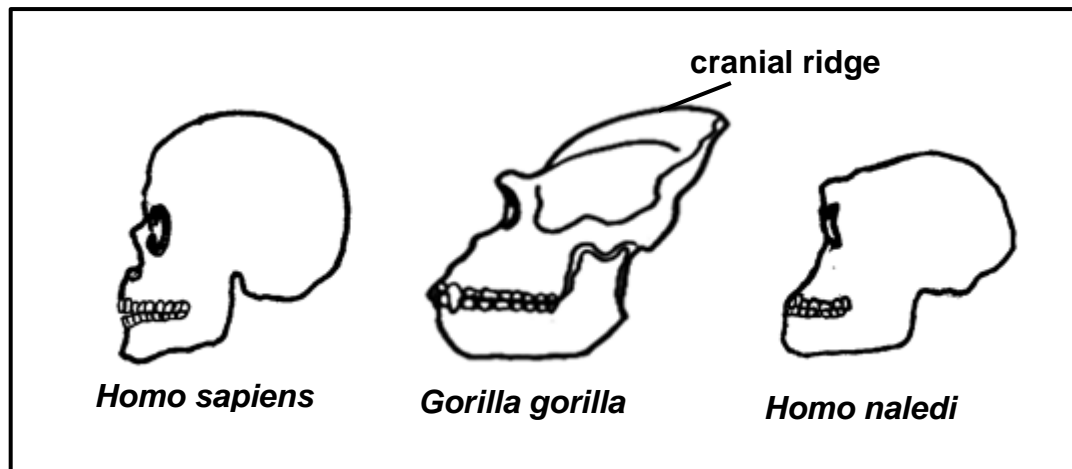
3.2.2 State TWO factors that were kept constant during the investigation. (2)

3.2.3 State TWO ways in which the reliability of this investigation was ensured. (2)

3.2.4 Explain why it would be expected that more stoneflies will have no wings in the areas without trees. (4)

3.2.5 Describe how Lamarck would have explained the evolution of stoneflies without wings in the areas without trees. (5)
(15)

- 3.3 Describe the process of speciation through geographic isolation. (7)
- 3.4 The diagrams below represent the skulls of hominids.



- 3.4.1 List THREE similarities in relation to vision that are shared by these organisms. (3)
- 3.4.2 Name ONE species in the diagram that was most prognathous. (1)
- 3.4.3 Describe the TWO structures that caused the species named in QUESTION 3.4.2 to be most prognathous. (2)
- 3.4.4 *Homo naledi* was bipedal for most of its adult life.
Explain how the structure of *Homo naledi*'s skull would have assisted in bipedalism. (3)
- 3.4.5 Describe the difference between *Homo sapiens* and *Gorilla gorilla* in relation to the shape of the:
(a) Spine (2)
(b) Pelvis (2)
- 3.4.6 Explain why the *Gorilla gorilla* species has a cranial ridge. (2)
- (15)**

3.5 Read the passage below.

Datura flowers open in the evening and release a powerful fragrance which attracts hawk moths. The Datura produces a highly addictive nectar which ensures that the hawk moths stay longer inside the flower and only visit Datura flowers.

- 3.5.1 Explain TWO ways in which the Datura plants ensure that they are reproductively isolated. (4)
- 3.5.2 State TWO other mechanisms that would ensure reproductive isolation in plants. (2)
- (6)**
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150