KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2

PREPARATORY EXAMINATION

SEPTEMBER 2023

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MARKS: 150

TIME: 2½ hours

This question paper consists of 17 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

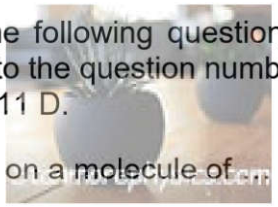
1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answers to each question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
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 may use a non-programmable calculator, protractor and a compass.
11. 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 to 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 An anticodon is a sequence of three nucleotides on a molecule of …

A DNA.
B tRNA.
C rRNA.
D mRNA.

1.1.2 An individual that has received a different allele from each parent for a particular characteristic is described as being …

A homologous.
B homozygous.
C recessive.
D heterozygous.

1.1.3 Which ONE of the following occurs in meiosis, but NOT in mitosis?

A Centrosomes form spindle fibres
B Reduce chromosome number by half
C Chromosomes are pulled towards opposite poles
D Chromosomes arrange at the equator of the cell

1.1.4 During which ONE of the following phases of meiosis does the random arrangement of chromosomes occur?

A Prophase I
B Prophase II
C Metaphase II
D Anaphase I

1.1.5 A horse has 64 chromosomes in a somatic cell. The gonosomes are the same as those in humans.

A normal horse sperm cell will have …

A 31 pairs of autosomes and an X chromosome.
B 32 autosomes and a Y chromosome.
C 32 autosomes and an X chromosome.
D 31 autosomes and a Y chromosome

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1.1.6 The insulin molecule contains 51 amino acids.

How many mRNA nucleotides code for this insulin molecule?

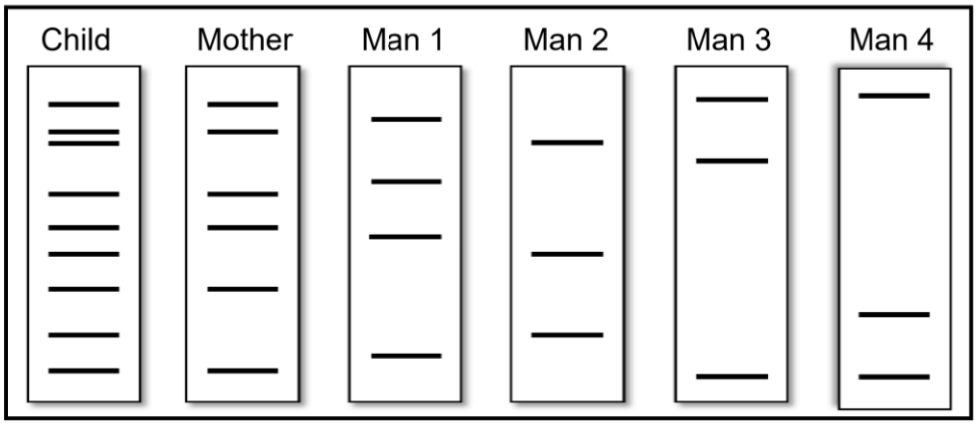
A 51
B 17
C 153
D 152

1.1.7 Which ONE of the following statements regarding chromosomes is correct?

A 22 pairs of chromosomes in humans are autosomes and 2 pairs of chromosomes are gonosomes
B Chromosomes are made up of DNA molecules and proteins
C Chromosomes are found in somatic cells only
D Chromosomes are thread-like structures located inside the nucleus of animal cells only

1.1.8 There is uncertainty about who the biological father of the child is. To establish paternity, DNA profiling was conducted.

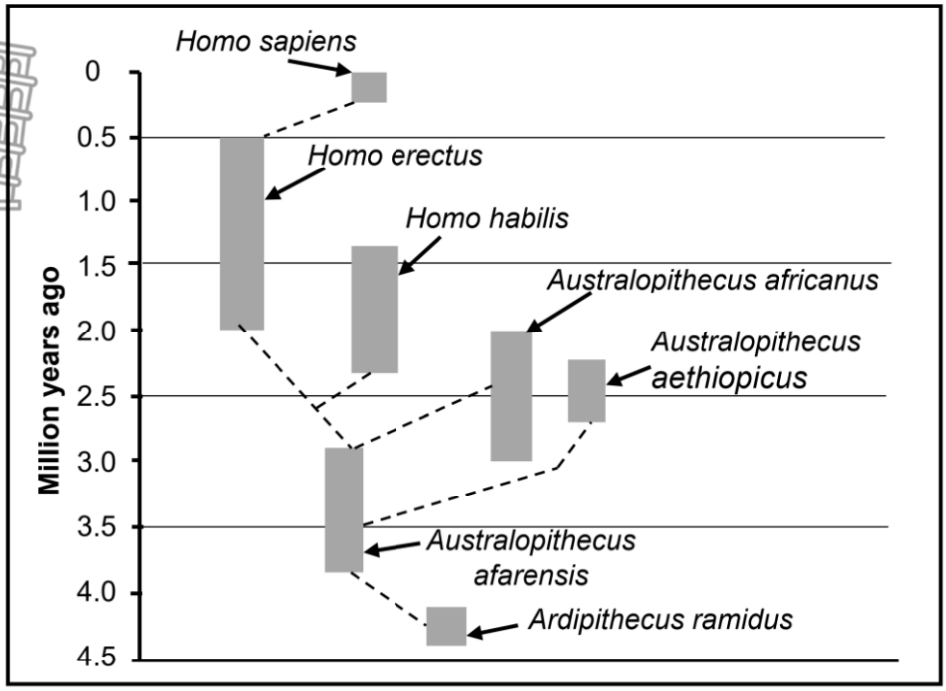
The diagram below shows the DNA profiles of a child, her mother and four men.



Which ONE of the following men is most likely to have been the father of the child?

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

1.1.9 The phylogenetic tree below shows the period of existence of some hominids.



Which ONE of the following tables best represents the information in the phylogenetic tree about the *Homo* species?

A

HOMINIDS	PERIOD OF EXISTENCE (mya)
Homo erectus	2 – 0.5
Homo sapiens	2 - present
Homo habilis	2.33 – 1.4

B

HOMINIDS	PERIOD OF EXISTENCE (mya)
Homo erectus	2 – 0.5
Homo sapiens	0.3 – 0.2
Homo habilis	2.6 – 1.4

C

HOMINIDS	PERIOD OF EXISTENCE (mya)
Homo erectus	2 – 1.5
Homo sapiens	0.2 - present
Homo habilis	2.33 – 1.4

D

HOMINIDS	PERIOD OF EXISTENCE (mya)
Homo erectus	2 – 0.5
Homo sapiens	0.2 - present
Homo habilis	2.33 – 1.4

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1.1.10 The effect of speciation through geographic isolation on a population of a single species includes …

A natural selection occurs dependently in each of the two populations
B gene flow between the two populations
C the two populations become different from each other
D the decrease to the variety of species that live on earth

(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 1.2.9) in the ANSWER BOOK.

1.2.1 Undifferentiated cells that may be stimulated to develop into any type of body cell

1.2.2 The point of crossing over between two adjacent chromosomes

1.2.3 The process by which genetically identical organisms are formed using biotechnology

1.2.4 The nitrogenous base found in DNA but not in RNA.

1.2.5 A sex-linked disorder that affects the photoreceptors in the eye

1.2.6 A sudden change in the sequence of nitrogenous bases of a nucleic acid

1.2.7 The breeding of organisms by humans to achieve a desirable phenotype

1.2.8 The type of evidence for human evolution that includes tool-making

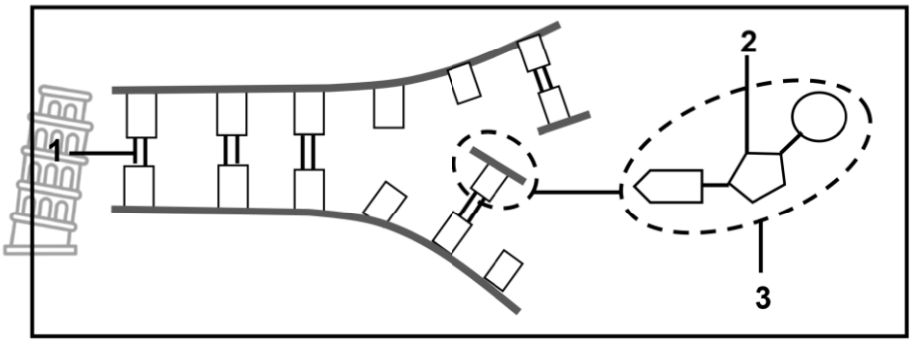
(8 x 1) **(8)**

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 number (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	Division of the cytoplasm	A: Meiosis I B: Meiosis II
1.3.2	Crossing over	A: Telophase I B: Prophase II
1.3.3	Principle of Segregation	A: Watson B: Gregor Mendel

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

1.4 The diagram below shows part of a process in a nucleic acid.



1.4.1 Name the:

(a) Process shown in the diagram (1)

(b) Nucleic acid shown in the diagram (1)

(c) Natural shape of the nucleic acid named in QUESTION 1.4.1 (b). (1)

1.4.2 Identify:

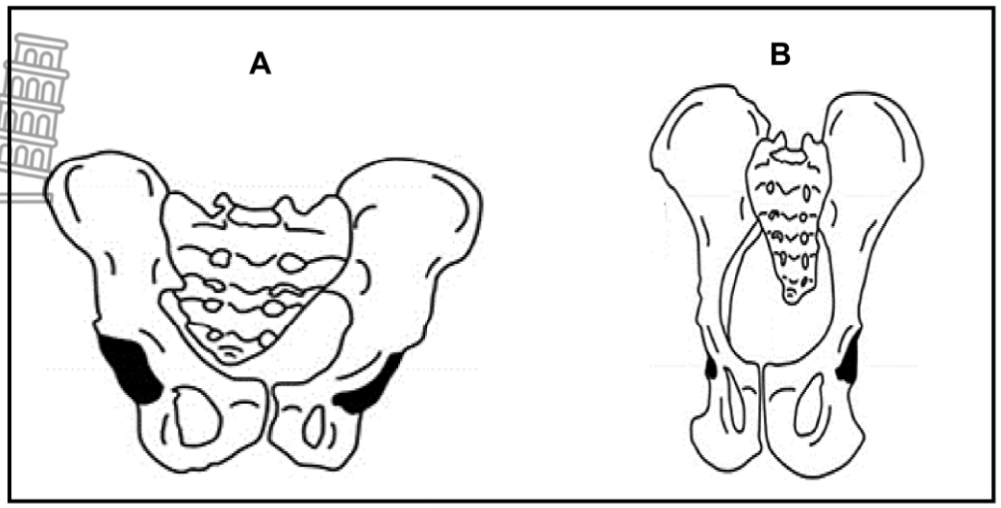
(a) Bond **1** (1)

(b) Part **2** (1)

(c) Structure **3** (1)

1.4.3 Name the organelle that is found in plant cells only, where the nucleic acid named in QUESTION 1.4.1 (b) is located. (1)
(7)

1.5 The diagrams below show the pelvis of *chimpanzee* and *Homo sapiens*.(not necessarily in that order)



1.5.1 Give the LETTER of the pelvis belonging to the species that has the:

(a) Foramen magnum in a more backward position (1)

(b) S-shaped Spine (1)

1.5.2 Name the species that is represented by the pelvis shown in diagram:

(a) **A** (1)

(b) **B** (1)

1.5.3 State TWO visible structural differences between the pelvis in diagram **A** and **B**. (4)

1.5.4 Give ONE significance of the shape of the pelvis shown in diagram **A**. (1)
(9)

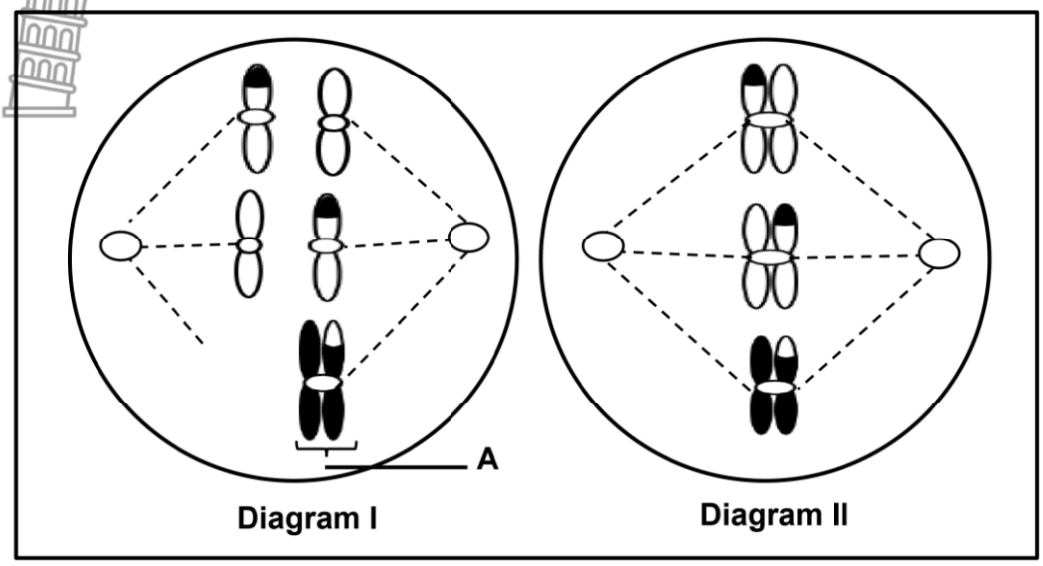
TOTAL SECTION A: 50

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SECTION B

QUESTION 2

2.1 The diagrams below show part of a phase in meiosis.



2.1.1 Identify:

(a) The phase represented in diagram **II**. (1)

(b) Part **A** (1)

2.1.2 Name the type of cell that results from meiosis. (1)

2.1.3 How many chromosomes were present in the cell at the beginning of meiosis? (1)

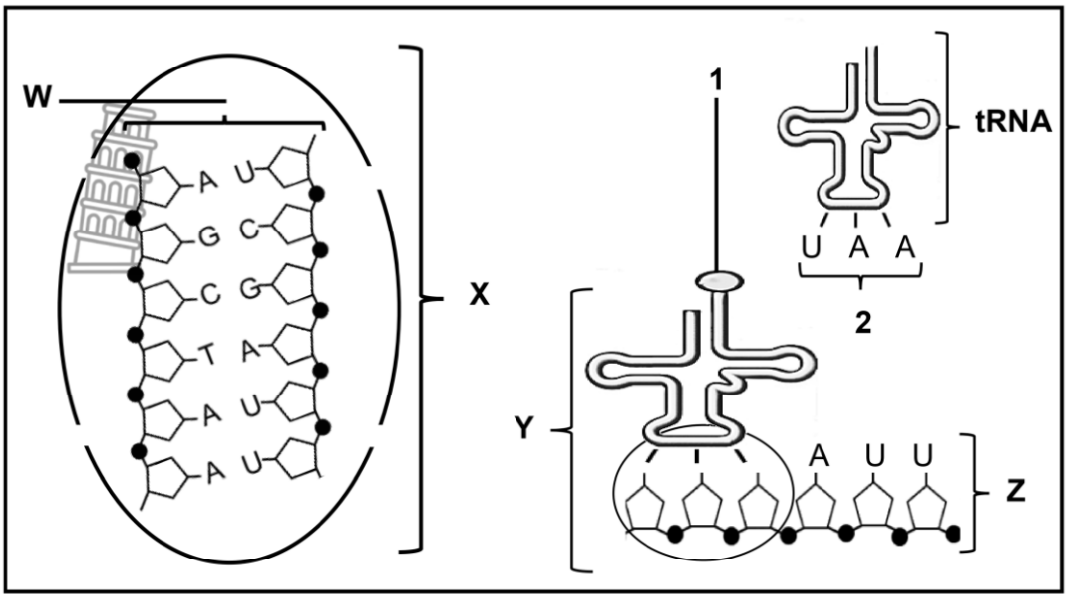
2.1.4 The cell in diagram **I** is undergoing abnormal meiosis:

(a) Give the term for abnormal meiosis. (1)

(b) Name the genetic disorder that would result in humans if this abnormal meiosis occurs in chromosome pair number 21. (1)

2.1.5 Explain why the cell in diagram **II** does not belong to a human. (2)
(8)

2.2 The diagram below represents part of the process of protein synthesis.



2.2.1 Identify:

(a) Organelle **X** (1)

(b) Monomer **1** (1)

2.2.2 Write down the DNA sequence for the base triplet **2**. (1)

2.2.3 Name and explain the importance of process **W** in protein synthesis. (3)

2.2.4 Describe the role of tRNA in the process of protein synthesis. (3)

2.2.5 The table below shows the codons that code for different amino acids.

CODON	AUC	UAC	UCG	AUU	UGC
AMINO ACID	Isoleucine	Tyrosine	Serine	Isoleucine	Cysteine

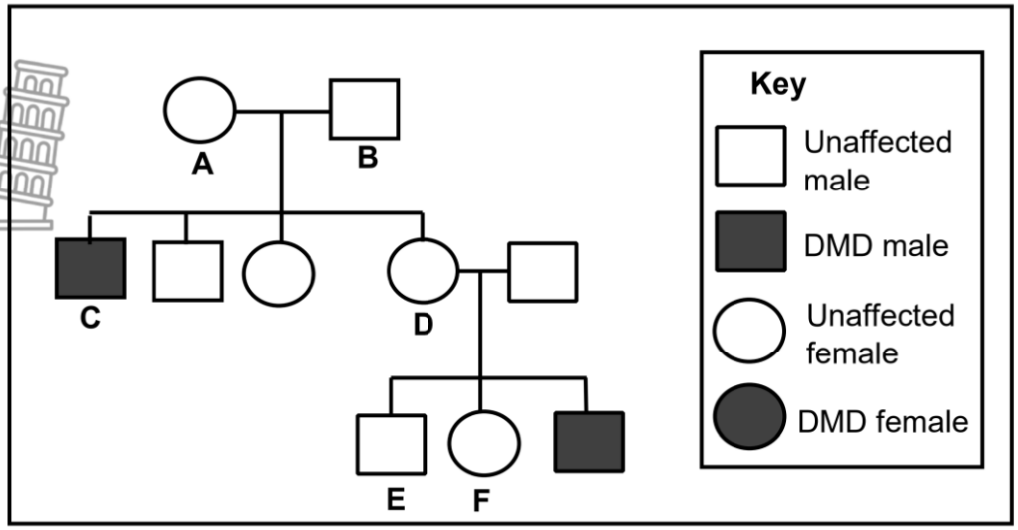
With reference to the diagram in QUESTION 2.2 and the table above:

(a) State the amino acid that is coded by the DNA base triplet AGC. (1)

(b) If the codon AUU on molecule **Z** change to AUC, explain the effect it would have on this particular protein molecule. (3)
(13)

2.3 Duchenne muscular dystrophy (DMD) is an inherited condition caused by a sex-linked recessive allele **(X^d)**.

The diagram below shows the inheritance of DMD in a family.



2.3.1 Name this type of a diagram. (1)

2.3.2 How many males are unaffected in the second generation? (1)

2.3.3 State the phenotype of individual **C**. (1)

2.3.4 Give all the possible genotypes of individual:

(a) **D** (1)

(b) **F** (2)

2.3.5 Explain why individual **A** can only be heterozygous for this condition. (3)

2.3.6 Individual **E** marries a heterozygous female. Calculate the percentage chance of their daughters having an allele for DMD. Show all working. (3)

2.3.7 Explain why DMD cannot be passed from father to son. (2)
(14)

2.4 Tay-sachs disease is an autosomal recessive (**r**) genetic disorder.

A boy has Tay-sachs disease and his sister is homozygous and unaffected.

Use a genetic cross to determine the genotypes and phenotypes of their parents. **(6)**

2.5 Three men were seriously injured in a motor car accident and could not be identified. One of them is suspected to be Sipho's father. The blood types of the three men was established and compared to the blood groups of Sipho and his mother. This evidence was not conclusive and DNA profiling had to be conducted.

The table below shows the blood types of Sipho, his mother and the three men.

INDIVIDUAL	BLOOD TYPE
Sipho	O
Sipho's mother	B
Man 1	A
Man 2	AB
Man 3	O

2.5.1 Give the:

(a) Genotype of Sipho's mother (1)

(b) Blood type that is controlled by the recessive allele (1)

2.5.2 Name the type of dominance that is shown by the genotype of Sipho's mother in QUESTION 2.5.1 (a). (1)

2.5.3 Which man could NOT be Sipho's father? (1)

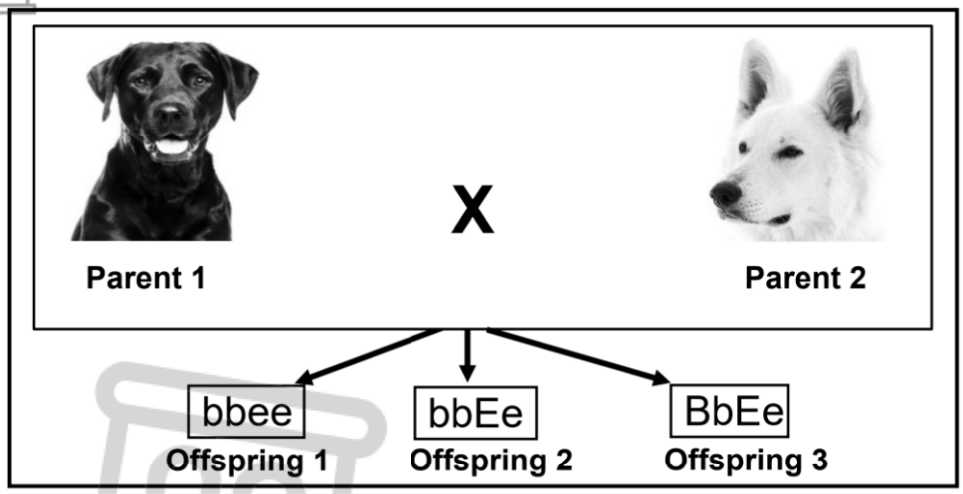
2.5.4 Explain why Sipho's father could not be identified by using blood groups only. (5)
(9)
[50]

QUESTION 3

3.1 In dogs, black fur (**B**) is dominant over white fur (**b**) and prick ear (**E**) is dominant over drop ear (**e**). Drop ear is caused by a recessive allele

A dog breeder crossed a black, drop-eared dog with a white, prick-eared dog.

The diagram below shows the parent dogs that were crossed and the genotypes of their three offspring.



3.1.1 Name this type of genetic cross. (1)

3.1.2 Describe what a *recessive allele* is. (2)

3.1.3 How many of the three offspring are white? (1)

3.1.4 Give the:

(a) Phenotype of offspring **3** (1)

(b) Genotype of parent **1** (2)

(c) Possible genotypes of the gametes of parent **2** (2)

3.1.5 Identify the offspring that:

(a) Has the same phenotype and genotype to that of parent **2** (1)

(b) Is homozygous for drop ear (1)
(11)

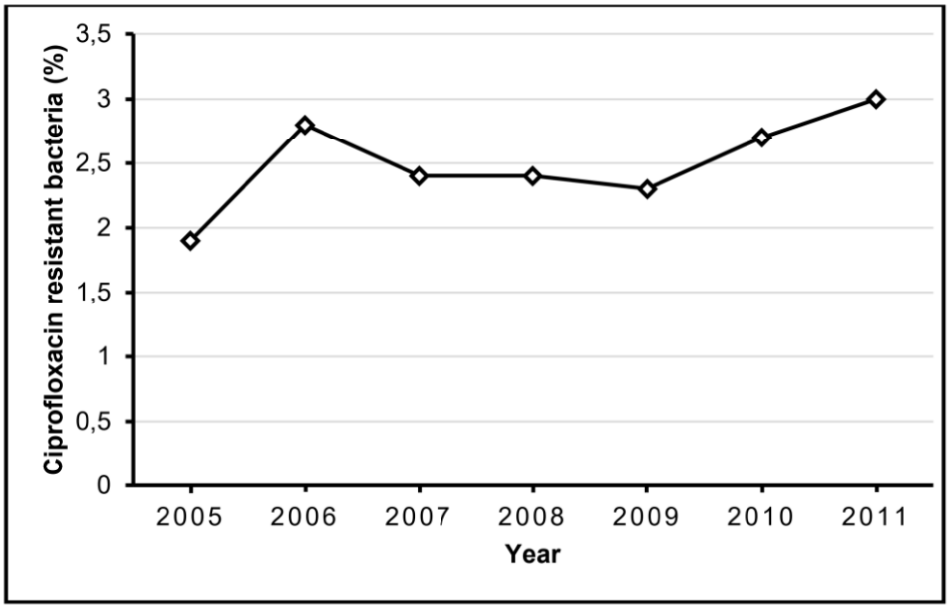
3.2 Read the extract below:

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Salmonellosis is a bacterial disease that affects the human intestinal tract. This disease is caused by salmonella bacteria. Most infected people have diarrhoea, stomach cramps and fever. The antibiotic, Ciprofloxacin, is used to control salmonella in humans. This antibiotic kills the salmonella, but it can also cause nausea and eye discomfort. It has been found that salmonella developed resistance to Ciprofloxacin treatment.

Salmonellosis was treated with Ciprofloxacin from 2005 to 2011 and the percentage of Ciprofloxacin resistant bacteria was recorded.

The results are shown in the graph below.



3.2.1 From the extract, identify TWO:

(a) Negative side effects of ciprofloxacin (2)

(b) Symptoms of salmonellosis (2)

3.2.2 Explain how the use of the antibiotic resulted in the evolution of ciprofloxacin resistant bacteria. (6)
(10)

3.3 Dark brown mice migrated to the Sand Hills of Nebraska. A mutation in one gene for fur colour resulted in light brown mice. Light brown mice camouflage well against the sand. Predators feed on the mice in the sand.

The colour of the mice depends on the mutation in a gene for fur colour.

Scientists carried out an investigation to determine the effect of fur colour on the percentage of mice killed by predators. The mice were not allowed to migrate from 1970 to 1974 and the percentage of mice killed by predators was recorded every year.

The table below shows the results of their investigation.

YEAR	MICE KILLED BY PREDATORS (%)	
	LIGHT BROWN MICE	DARK BROWN MICE
1970	2	4
1971	1.5	6
1972	2	6.5
1973	1	7
1974	0.5	10

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3.3.1 Identify the:

(a) Dependent variable (1)

(b) Independent variable (1)

3.3.2 Name ONE advantage of the mutation to the mice. (1)

3.3.3 Give ONE way in which the reliability of the results was ensured. (1)

3.3.4 State ONE conclusion that can be drawn from the results of the investigation. (2)

3.3.5 Draw two bar graphs for the first three years on the same set of axes to represent the information in the table. (6)
(12)

3.4 Read the passage below on human evolution.

Fossil evidence indicate that modern humans originated in Africa and then migrated to other continents. The following fossils serve as evidence for this migration: *Ardipithecus*, *Australopithecus* and *Homo* (*Homo habilis*, *Homo erectus* and *Homo sapiens*).

3.4.1 Name the hypothesis on human evolution that is described in the passage. (1)

3.4.2 From the passage, identify TWO of the:

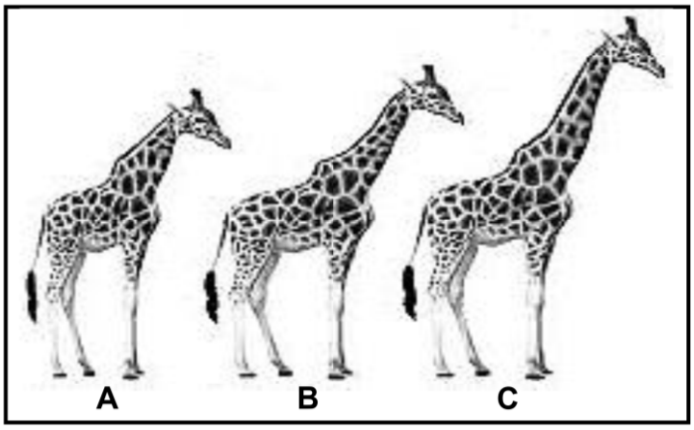
(a) Oldest fossils that were found in Africa (2)

(b) Fossils that were found in Africa only (2)

3.4.3 Name the family to which *Homo sapiens* belong. (1)

3.4.4 Give ONE evidence other than the fossil indicating that modern humans originated in Africa. (1)
(7)

3.5 The diagrams of giraffes below show evolution.



3.5.1 Give ONE reason why Giraffe **B** may be described as a transitional species? (1)

3.5.2 Describe how Lamarck had explained the evolution of the long neck of the giraffe. (4)
(5)

3.6 Read the passage below:

Squirrels are believed to have been evolved from one common ancestor species.

Scientists conducted an investigation to find out whether the grey and brown squirrels belong to the same species. They allowed grey and brown squirrels to interact in the same habitat for three years. They observed that the population of brown squirrels bred from April to June only, whereas grey squirrels bred from August to October only.

3.6.1 Based on the passage, name the type of reproductive isolation mechanism displayed by the grey and brown squirrels. (1)

3.6.2 State TWO reproductive isolation mechanisms in animals other than the one named in QUESTION 3.6.1. (2)

3.6.3 Explain how would scientists confirm if the two squirrel types belong to different species? (2)
(5)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150