



Province of the
EASTERN CAPE
EDUCATION

BCM

AIM TO PASS

GRADE 12 LIFE SCIENCES REVISION DOCUMENT PAPER 2 Learner's Book 2024



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TABLE 1: HOW TO PASS LIFESCIENCES

TOPIC	How to achieve 30%	How to achieve 40%	How to achieve 50%
GENERAL	➤ Terminology ➤ Definitions ➤ Diagrams of structures ➤ Labels and functions	➤ Calculation skills ➤ Graph skills ➤ Interpretation of graphs ➤ Calculating % increase ➤ Calculating % ➤ Interpretation and the drawing of the following types of Graphs: • Line graph • Histogram • Bar graph • Pie chart	➤ Scientific investigation skills ➤ Reading with understanding ➤ Identifying variables (independent, dependent, constant) ➤ Stating a hypothesis ➤ Identifying the aim of an investigation ➤ Stating planning steps for an investigation ➤ Writing a conclusion From results provided ➤ Answering questions based on a given extract.

1. DNA CODE OF LIFE

Topic	How to achieve a pass
DNA: Code of Life (27 marks)	Terminology Definitions Diagrams of Structures Labels and Functions Structure of DNA and RNA nucleotides DNA Replication & Protein synthesis DNA profiles

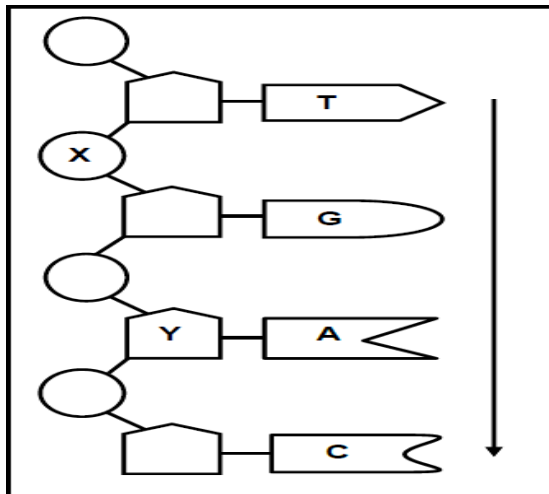
TERMINOLOGY

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers.

	DESCRIPTION
1	A tangled network of DNA and protein located within the nucleus
2	The bonds that hold the two strands of a DNA molecule together.
3	The sugar found in DNA
4	The analysis of DNA samples to identify individuals that may be related
5	The process whereby DNA makes an exact copy of itself
6	The monomers of nucleic acids
7	The natural shape of a DNA molecule
8	Sections of DNA that carry hereditary information
9	The sugar that forms part of a nucleotide in RNA
10	The process whereby mRNA is formed from DNA
11	Base triplets found on mRNA
12	The cell organelle to which mRNA attaches during protein synthesis
13	The process of arranging amino acids according to the sequence of bases on mRNA
14	The organelle in a cell where translation occurs
15	The triplet of bases found on a tRNA molecule
16	The type of RNA containing anticodons
17	Bonds that join amino acids together
	(17 x 1)

Question 1.1

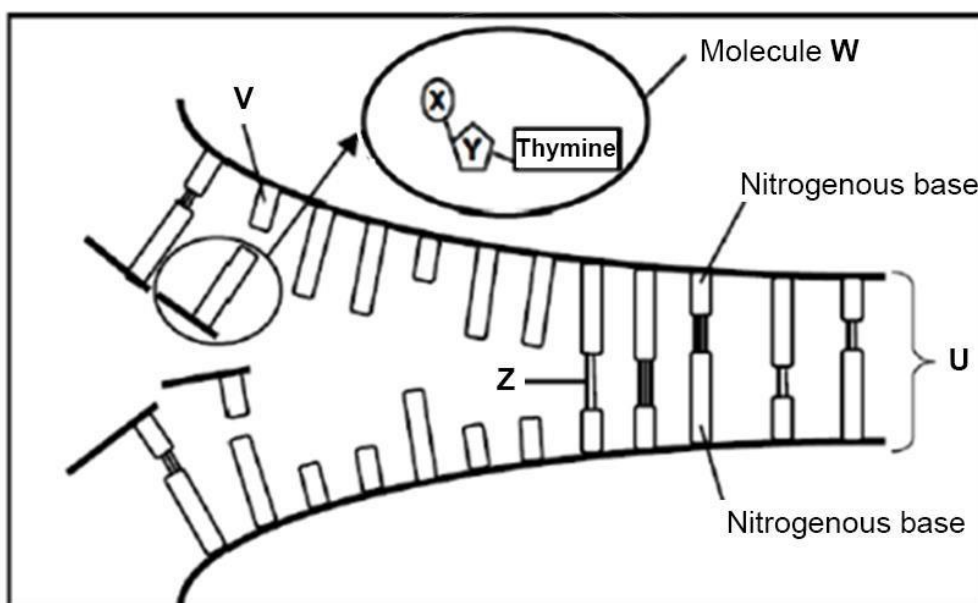
The diagram below represents some nucleotides in a single strand of DNA.



- 1.1.1 Give the LETTER of the part that represents a: (1)
(a) Sugar molecule (1)
(b) Phosphate molecule (1)
- 1.1.2 How many nucleotides are represented in the diagram? (1)
- 1.1.3 Write down the nitrogenous bases (from top to bottom as indicated by the arrow) of the complementary DNA strand of this molecule. (1)
- 1.1.4 Name TWO processes that require the two strands of a DNA molecule to separate into single strands as shown in the diagram. (2)
(6)

Question 1.2

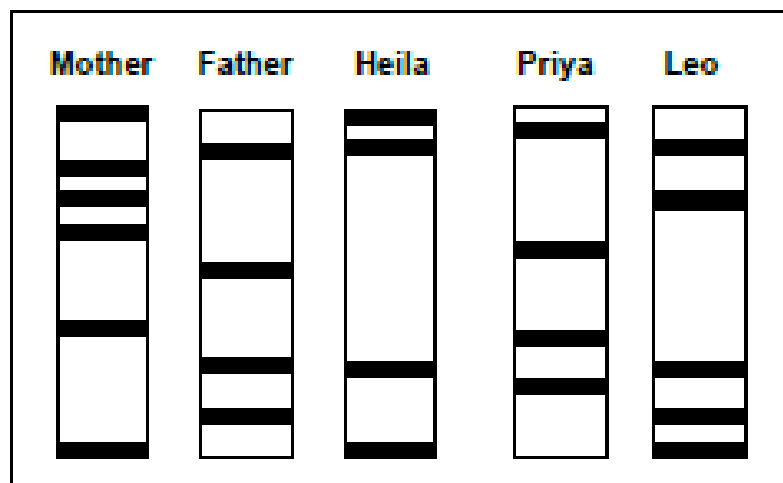
The diagram below represents DNA Replication.



- 1.2.1 Identify the following:
- (a) Molecules **W** and **U**. (2)
 - (b) Parts of molecule **W** labelled **X** and **Y**. (2)
 - (c) Bond **Z**. (1)
 - (d) Nitrogenous base **V**. (1)
- 1.2.2 Where in the cell does this process take place? (1)
- 1.2.3 Name the phase of the cell cycle where replication takes place. (1)
- (8)**

Question 1.3

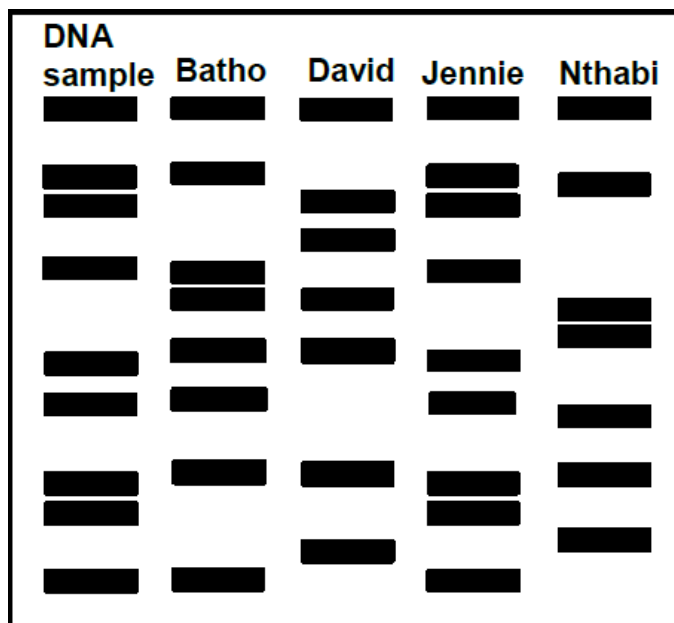
The diagram below represents the DNA profiles of three children and their parents. Only two of their children and one is adopted.



- 1.3.1 Identify the TWO biological children. (2)
- 1.3.2 Explain your answer to QUESTION 1.3.1 (2)
- 1.3.3 State THREE other uses of DNA profiling (3)
- (7)**

Question 1.4

Detectives were investigating a crime scene and found blood on a broken window. They suspected that the blood was that of the criminal. To identify the criminal, they analysed a DNA sample from the blood and compared it to that of four suspects. The diagram below was produced:

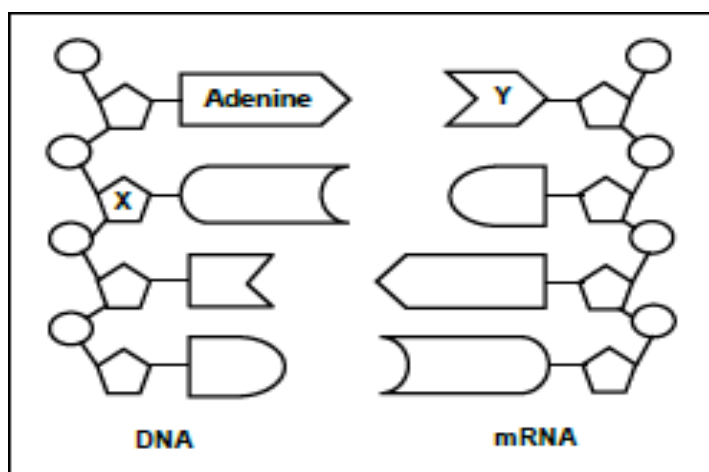


- 1.4.1 Name the technique that was used to identify the criminal. (1)
- 1.4.2 Who is the possible criminal? (1)
- 1.4.3 Explain your answer to QUESTION 1.4.2. (2)
- 1.4.4 State ONE other use of the technique identified in QUESTION 1.4.1. (1)
- 1.4.5 Give TWO views against the use of the technique identified in QUESTION 1.4.1. (2)

(7)

Question 1.5

The diagram below represents transcription during protein synthesis.

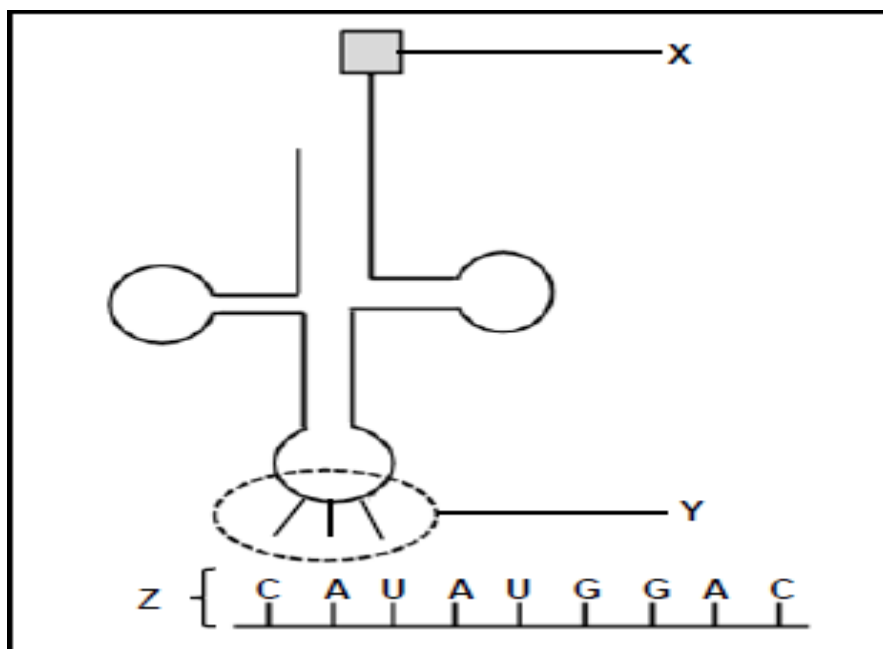


- 1.5.1 Name the part of the cell where this process occurs (1)

- 1.5.2 Identify:
- (a) Sugar X (1)
 - (b) Nitrogenous base Y (1)
- 1.5.3 Tabulate TWO differences between transcription and DNA replication (5)
- (8)**

Question 1.6

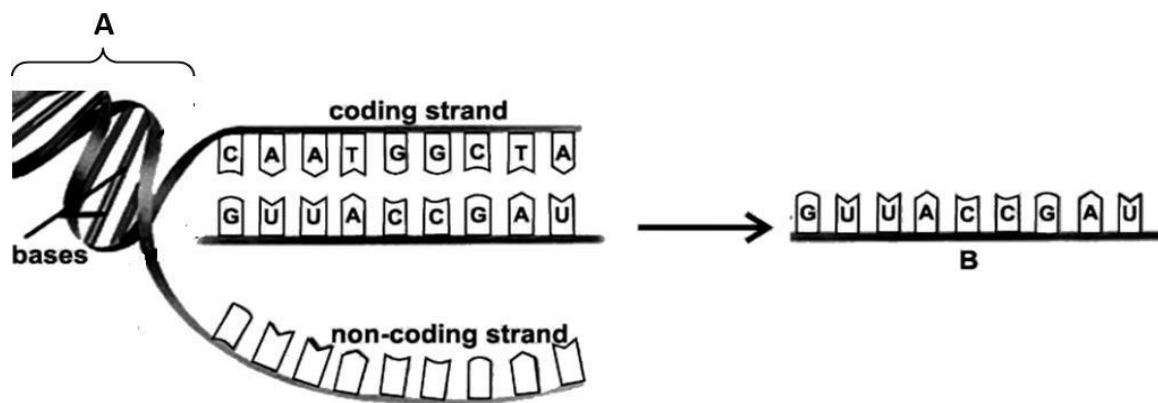
The diagram below represents a process that occurs during protein synthesis.



- 1.6.1 Identify molecule:
- (a) X (1)
 - (b) Z (1)
- 1.6.2 Give the nitrogenous base sequence of:
- (a) The DNA base triplet complementary to the middle codon on molecule Z. (2)
 - (b) Y (1)
- 1.6.3 Name and describe the process shown in the diagram during the formation of a protein. (7)
- (12)**

Question 1.7

The diagram below shows parts of Protein synthesis.



- 1.7.1 Name the process shown in the diagram above. (1)
 - 1.7.2 Identify molecule B. (1)
 - 1.7.3 State TWO functions of molecule A. (2)
 - 1.7.4 Tabulate TWO observable differences between molecules A and B. (5)
 - 1.7.5 Describe the process that is responsible for the formation of molecule B. (6)
 - 1.7.6 Explain how the protein molecule would be affected if codon GUU is changed to GUC on molecule B. (3)
- (18)

Question 1.8

A mutation had occurred on a section of mRNA molecule as shown below.

Original sequence	AUG GAA AUA CCG CCA GGA
Mutated sequence	AUG GAA AUA CUG CCA GGA

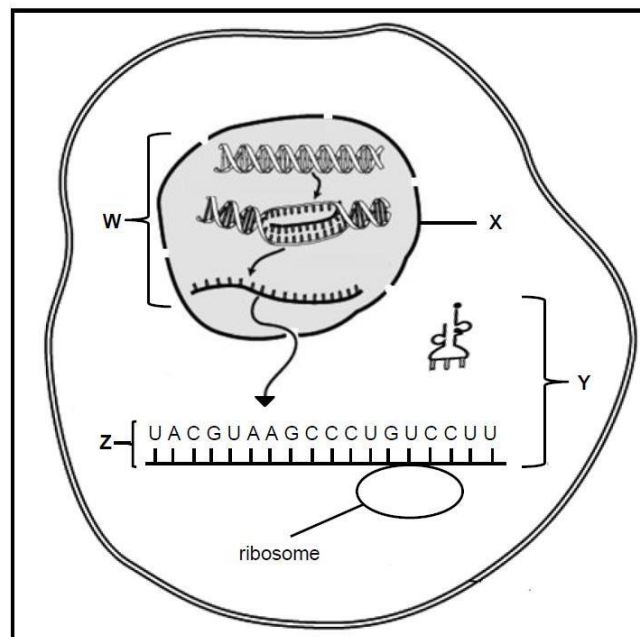
- 1.8.1 Name the mutation that has occurred (1)
- 1.8.2 Give a reason for your answer to QUESTION 1.8.1 (1)
- 1.8.3 The table below show some mRNA codons and the amino acids that they code for.

mRNA codon	Amino acid
AUA	Isoleucine
AUG	Methionine
CCA	Proline
CCG	Proline
CUG	Leucine
GAA	Glutamic acid
GGA	Glycine

- (a) State the number of different amino acids coded for by the original sequence of the mRNA molecule given above. (1)
- (b) Give the anticodon on the tRNA molecule that carries the amino acid isoleucine. (1)
- (c) Use information in the table to describe the effect of the mutation on the protein formed (4)
- (8)**

Question 1.9

The diagram below represents the process of protein synthesis in a cell.



- 1.9.1 Name the process which occurs at:
- (a) **W**. (1)
- (b) **Y** (1)
- 1.9.2 Identify:
- (a) Organelle **X**. (1)
- (b) Molecule **Z** (1)
- 1.9.3 State TWO locations of DNA in a cell, other than in the nucleus. (2)
- 1.9.4 Describe the process at
- (a) **W** (7)
- (b) **Y** (6)

The table below shows some tRNA anticodons with their corresponding amino acids.

tRNA ANTICODON	AMINO ACID
CAG	Valine
GAA	Leucine
AUG	Tyrosine
GGA	Proline
UCG	Serine
CAU	Valine

1.9.5 Name the:

- (a) DNA base triplet that codes for serine (1)
- (b) First TWO amino acids coded for by molecule **Z** in the diagram (the molecule is read from left to right). (2)

1.9.6 What is the change in the sequence of nitrogenous bases in a DNA molecule called? (1)

1.9.7 The codon CUU (last codon) on molecule **Z** changed to CCU.
Explain the effect it would have on this particular protein molecule. (3)
(26)

Question 1.10

A section of a DNA molecule has the following base sequence:

C T T A C A

- 1.10.1 Name the nitrogenous base represented by **C** in the DNA molecule. (1)
- 1.10.2 The percentage of guanine in this DNA molecule is 30%.
Give the percentage of thymine in the same amino acid. (2)
- 1.10.3 Give the mRNA sequence, from left to right, for this segment of DNA. (2)

The table below shows the DNA triplets that code for some amino acids.

DNA TRIPLET	AMINO ACID
ACA	Cysteine
CTT	Glutamic acid
TGT	Threonine
TTA	Asparagine
GAA	Leucine
TAC	Methionine

- 1.10.4 Give the sequence of amino acids that would be coded for by the section of DNA above. (2)
- 1.10.5 Give the anticodon for the amino acid methionine. (1)
(8)

2. MEIOSIS

Meiosis (21marks)	Diagrams of all the phases of meiosis I and II Importance of meiosis
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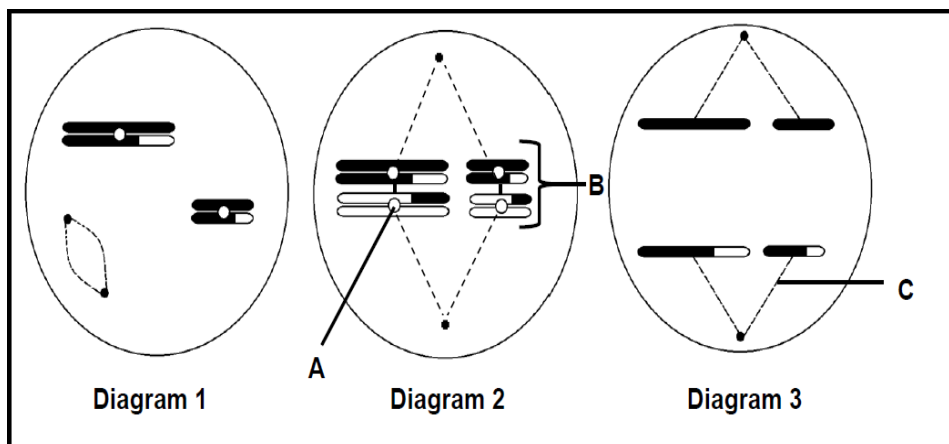
TERMINOLOGY

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers.

	DESCRIPTION
1	The point of crossing over between two adjacent chromosomes
2	The splitting of the cytoplasm during cell division
3	The failure of chromosome pairs to separate during meiosis
4	The structures in the cell that forms the spindle fibres.
5	The phase of meiosis when homologous chromosomes are aligned at the equator of the cell.
6	The point at which the two chromatids of a chromosome are joined together
7	The division of the nucleus
8	Exchange of genetic material between chromatids of homologous chromosomes
9	Site of meiosis in females
10	A genetic disorder caused by having an extra copy of chromosome number 21
11	The Structure formed by the centrioles during cell division
12	The non-sex chromosomes in humans
13	The condition in a cell where there is only one set of chromosomes
14	The structure that is responsible for the formation of spindle fibres during cell division in animal cells and is made up of two centrioles
15	The phase in the cell cycle during which the cell growth occurs
16	Chromosome that carries the same set of genes.
17	The structure that joins two chromatids of a chromosome
18	The division of the cytoplasm of a cell during cell division
19	The process during meiosis where there is an exchange of genetic material between chromatids
20	The structures in animal cells that give rise to spindle fibres during cell division
21	The phase in the cell cycle during which DNA replication takes place
22	The point where adjacent chromatids overlap during meiosis
23	The representation showing the arrangement of a diploid set of chromosomes
(23x1)	

Question 2.1

The diagram below represents different phases of meiosis in the diagram.



2.1.1 Identify:

(a) A

(1)

(b) B

(1)

(c) C

(1)

2.1.2 Identify phase represented in **Diagram 3**.

(1)

2.1.3 Write down the numbers of the diagrams to show the sequence in which the phases occur.

(2)

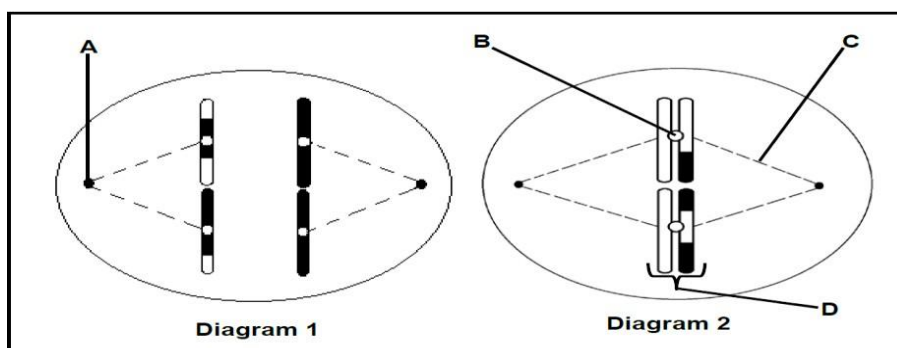
2.1.4. State ONE difference between metaphase II and metaphase II.

(2)

(8)

Question 2.2

The diagram below represents two phases of meiosis in an organism.



2.2.1 Identify the phase of meiosis represented in Diagram 1

(1)

2.2.2 Identify part:

(a) A

(1)

(b) B

(1)

(c) C

(1)

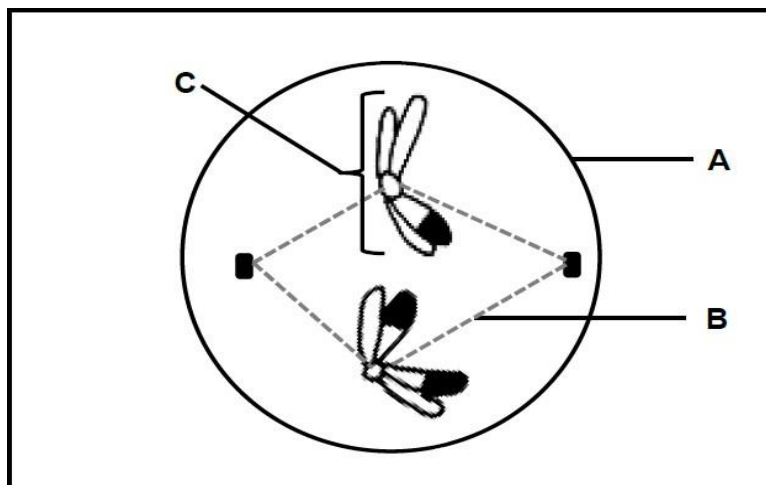
2.2.3 State what happens to structure D in the next phase of meiosis.

(1)

- 2.2.4 Name the process during which genetic material was exchanged as shown in diagrams above. (1)
- 2.2.5 State the consequence if the process named in QUESTION 2.2.4 does not occur. (1)
- 2.2.6 Give the number of chromosomes present in: (1)
- (a) The original parent cell in this organisms (1)
- (b) A human cell in the same phase as that shown in Diagram 2 (1)
- (9)**

Question 2.3

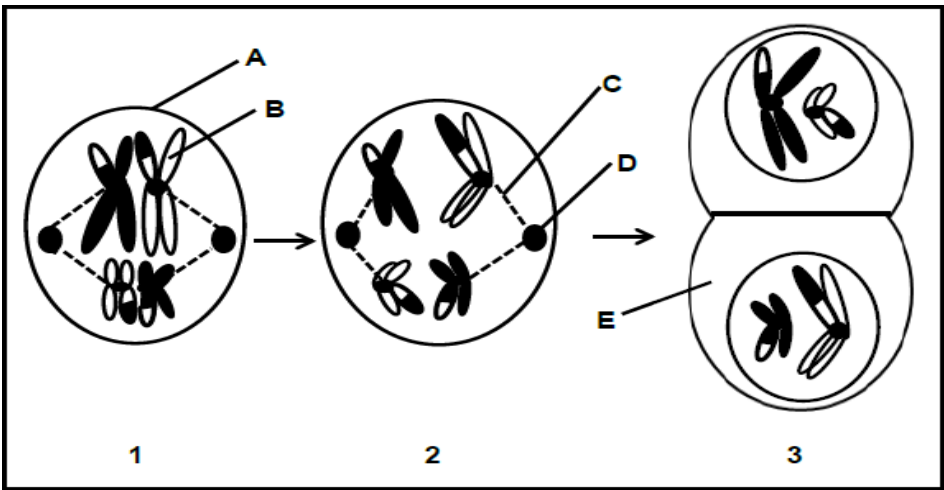
The diagram below represents the one cell in a phase of meiosis.



- 2.3.1 Identify the phase of meiosis shown in the diagram. (1)
- 2.3.2 Give ONE observable reason for your answer to QUESTION 6.1. (2)
- 2.3.3 Identify structure: (1)
- (a) A (1)
- (b) B (1)
- 2.3.4 Describe the role of part **B** in the movement of chromosome during meiosis. (2)
- 2.3.5 Draw a labelled diagram of structure **C** as it would appear in the final phase of this meiotic division. Show the correct shading. (4)
- (11)**

Question 2.4

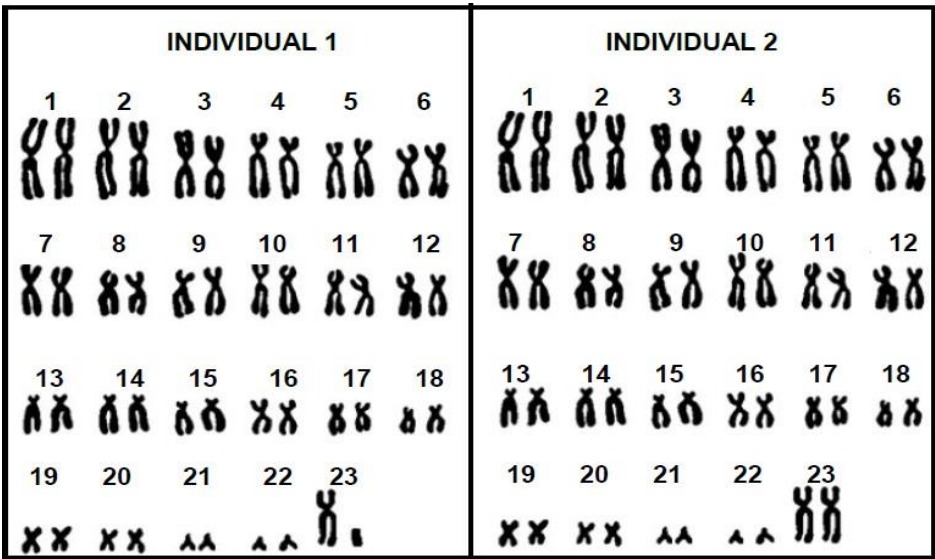
Diagrams 1 to 3 below show some of the phases of meiosis in the correct order.



- 2.4.1 Identify the phase represented by the diagram: (1)
- (a) 1 (1)
- (b) 3 (1)
- 2.4.2 Give the LETTER only of the part that: (1)
- (a) contains DNA (1)
- (b) attaches to the centromeres of chromosomes (1)
- (c) forms spindle fibres (1)
- 2.4.3 Name the organ in a human male where meiosis occurs. (1)
- (6)

Question 2.5

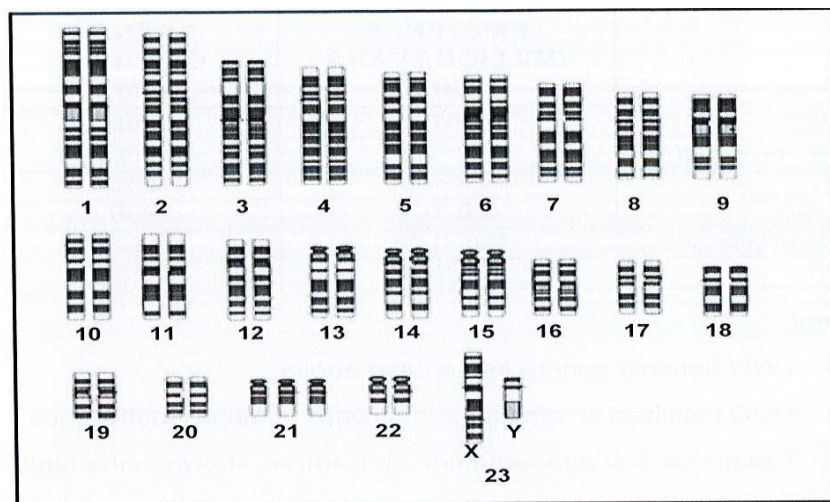
Diagram below represent chromosome from the human somatic cell of two individuals who are twins.



- 2.5.1 Identify the type of chromosomes numbered **1** to **22**. (1)
- 2.5.2 Each of the pairs shown is a homologous pair of chromosomes.
 (a) State the origin of each chromosome in a homologous pair during zygote formation. (2)
 (b) List **THREE** characteristics that chromosomes in a homologous pair have in common. (3)
- 2.5.3 Explain **ONE** observable reason why the two individuals are not identical twins (3)
(9)

Question 2.6

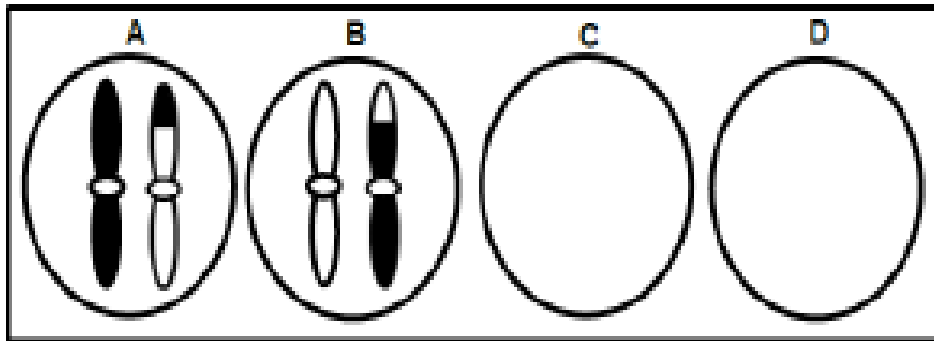
The diagram below shows the karyotype of an individual with a disorder caused by non-disjunction.



- 2.6.1 Name: (1)
- (a) This disorder (1)
 (b) The phase in meiosis when non-disjunction occurs (1)
 (c) The type of mutation that is a result of non-disjunction (1)
(3)

Question 2.7

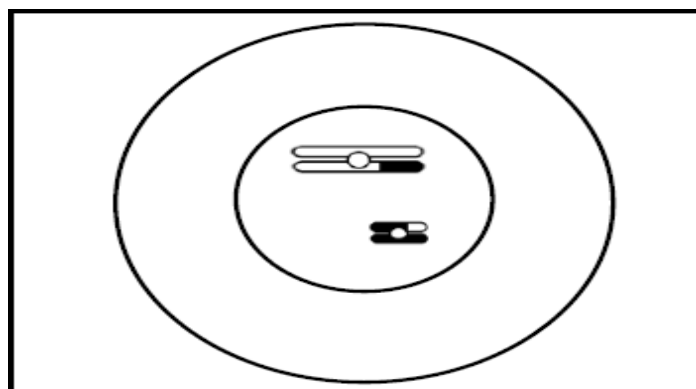
The diagram below represents the distribution of chromosome pair 21 as it appears in each gamete at the end of meiosis II in human male.



- 2.7.1 Explain why the gamete represented by diagram C and D do not have any chromosomes. (3)
- 2.7.2 If gamete A is involved in fertilisation, describe how this may result in Down syndrome. (3)
- 2.7.3 Due to the process of crossing over, the chromosomes in diagram A and B appear different to each other. (1)
- (a) Identify the phase of meiosis during which crossing over occurs. (3)
- (b) Describe the events during crossing over. (3)
- (10)**

Question 2.8

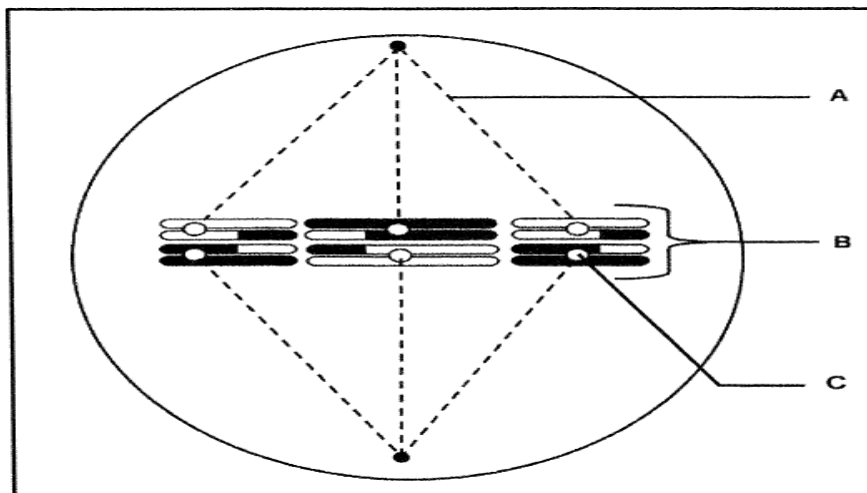
The diagram below represents one of the two cells that formed during Telophase I of meiosis in an organism.



Draw a labelled diagram to show the cell during Anaphase II of meiosis. (5)

Question 2.9

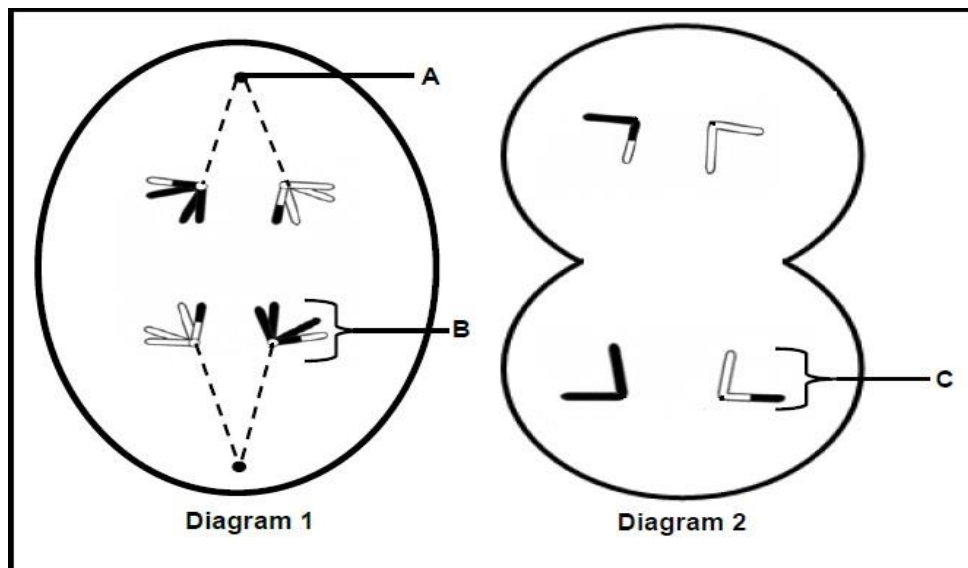
The diagram below shows a phase during meiosis in an animal cell.



- 2.9.1 Identify part labelled C. (1)
- 2.9.2 Name the phase represented in the diagram above. (1)
- 2.9.3 B represents the homologous chromosomes.
What are homologous chromosomes? (2)
- 2.9.4 Explain the appearance of chromosome in the diagram. (3)
- 2.9.5 State the function of part A in the phase following the one represented in the diagram. (1)
- 2.9.6 The total amount of DNA is 12 arbitrary units in each daughter cell at the end of this cell division.
How much DNA (in arbitrary units) was in the parent cell at the beginning of the cell division? (2)
- (10)**

Question 2.10

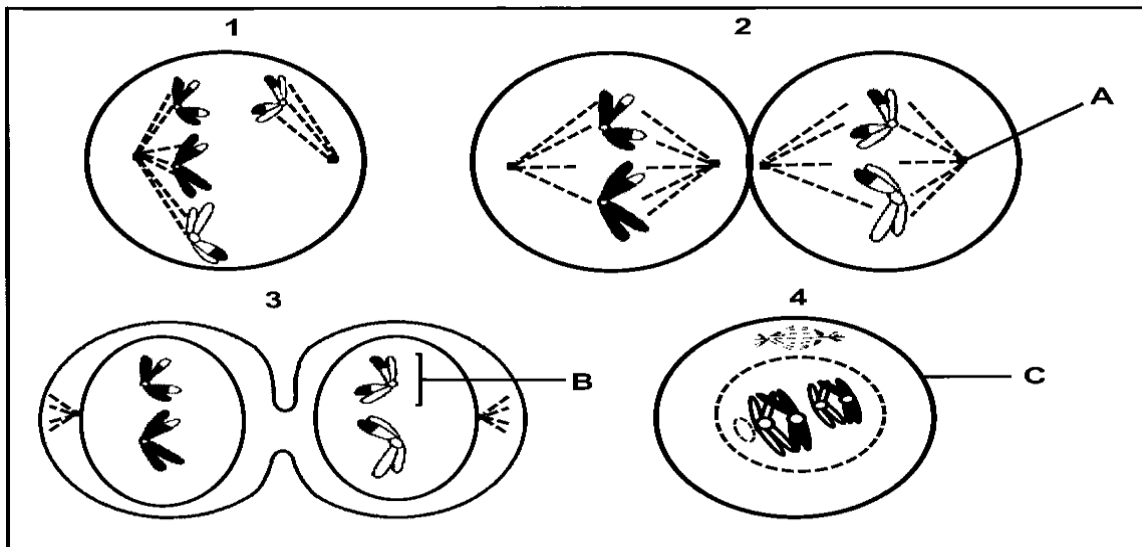
The diagram below represents two phases of meiosis



- | | | |
|--------|--|-------------|
| 2.10.1 | Identify part A. | (1) |
| 2.10.2 | Identify the phase represented by diagram 1. | (1) |
| 2.10.3 | Describe the events that took place in the phase before the one represented in diagram 2. | (2) |
| 2.10.4 | Name the process that causes the chromosomes to have the combination of genes as shown in diagrams. | (1) |
| 2.10.5 | Give ONE reason why the process named in Question 2.10.4 is important. | (1) |
| 2.10.6 | If this was a human cell, how many chromosome will be present in the cell during the phase represented in diagram 1. | (1) |
| 2.10.7 | Structure B and structure C are both chromosomes.
Explain why they are structurally different. | (3) |
| | | (10) |

Question 2.11

Diagram below represents different phases of meiosis.



2.11.1 Identify part:

- | | | |
|-----|---|-----|
| (a) | A | (1) |
| (b) | B | (1) |
| (c) | C | (1) |

2.11.2 Give the NUMBER and NAME of the phase which shows the following:

- | | | |
|-----|---|-----|
| (a) | Random arrangement of chromosome at the equator | (2) |
| (b) | Crossing over | (2) |
| (c) | Non-disjunction | (2) |

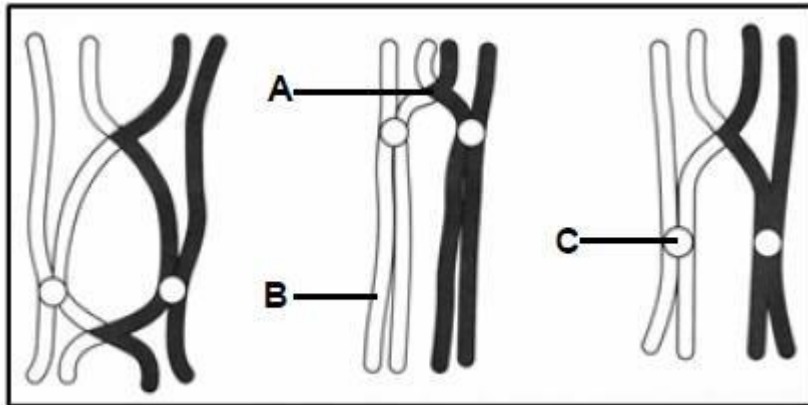
2.11.3 How many chromosome will be found in?...

- | | | |
|-----|---|-----|
| (a) | The cell at the end of meiosis shown in the diagrams. | (1) |
| (b) | A normal, human sperm. | (1) |
| (c) | The somatic cell of the normal mother who has a son with Down syndrome. | (1) |

(12)

Question 2.12

The diagram below represents ALL the chromosomes in a cell that is undergoing normal cell division.



2.12.1 Name the:

(a) Type of cell division that is occurring in the cell in the diagram (1)

Phase of cell division during which chromosomes behaves as shown in

(b) the diagram (1)

2.12.2 Where in human female body would the type of cell division named in QUESTION 16.1 (b) take place? (1)

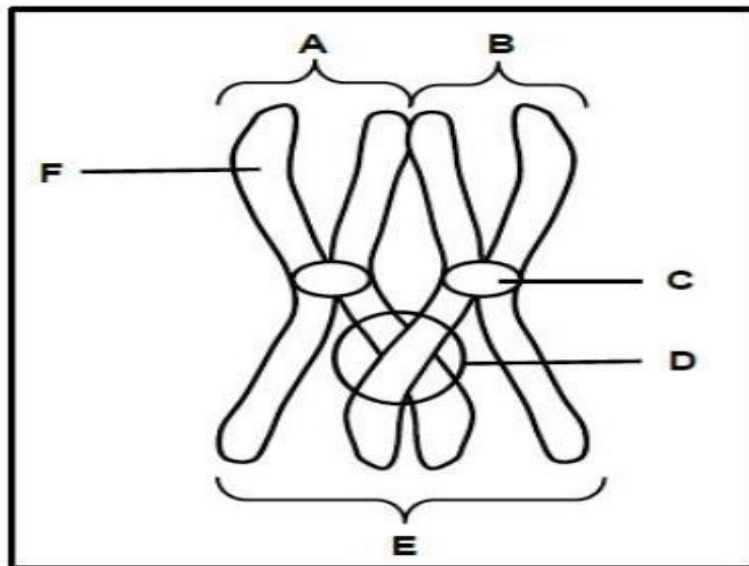
2.12.3 Give the LETTER and NAME of the structure that attaches to the spindle fibres (2)

2.12.4 How many chromosomes will be found in each daughter cell at the end of this cell division? (1)

(6)

Question 2.13

Study the diagram below.



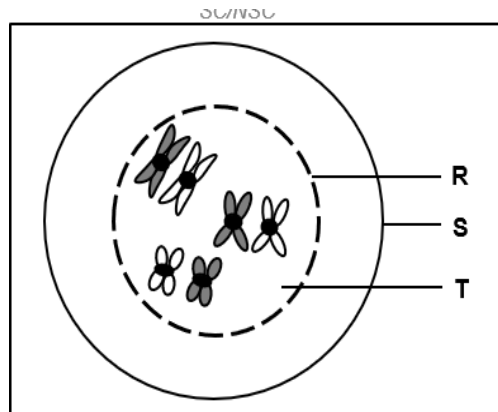
- 2.13.1 Identify part: (1)
- (a) C (1)
 - (b) D (1)
 - (c) E (1)
 - (d) F 1)
- 2.13.2 Name TWO ways in which structure A and B are similar to one another. (2)
- 2.13.3 Describe the process that occurs at D. (5)
- 2.13.4 A certain species has 42 chromosomes in its muscle cells. Give the number of chromosomes in each:
- (a) of all sperm (1)
 - (b) of its skin cells (1)
 - (c) ova of its female counterpart (1)
- (14)**

Question 2.14

Describe how non-disjunction may lead to Down syndrome. (5)

Question 2.15

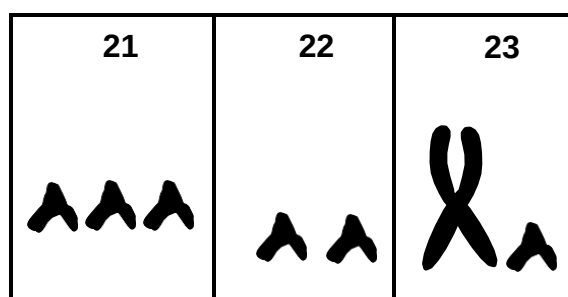
The diagram below represents part of an abnormal human karyotype.



- 2.15.1 Give the
- (a) Phase of meiosis represented (1)
 - (b) Number of chromatids shown (1)
 - (c) Number of homologous chromosome pairs (1)
- 2.15.2 Identify the following
- (a) R (1)
 - (b) S (1)
 - (c) T (1)
- 2.15.3 Name TWO organs in an animal where meiosis occurs. (2)
- (8)**

Question 2.16

The diagram below represents part of an abnormal human karyotype.



- 2.16.1 How many autosomes are shown in the diagram? (1)
- 2.16.2 Name the type of chromosomes represented by pair 23. (1)
- 2.16.3 Name the:
- (a) Disorder represented in the diagram (1)
 - Process during anaphase of meiosis that resulted in the abnormal number (1)
 - (b) of chromosomes in this karyotype (1)
- 2.16.4 State the gender of the person represented in this karyotype. (1)
- (5)**

3 GENETICS

TERMINOLOGY

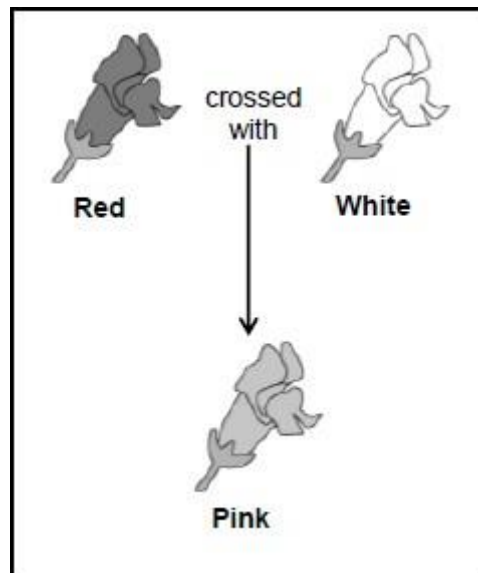
Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers.

	DESCRIPTION
1	The study of heredity and variation in organisms
2	All the genes that make up an organism
3	Two or more alternative forms of a gene at the same locus
4	The position of a gene on a chromosome
5	The no-sex chromosomes in humans
6	An inherited disorder where blood fails to clot properly
7	The number, shape and arrangement of all chromosomes in the nucleus of a somatic cell
8	A genetic cross involving one gene and its alleles
9	A genetic disorder where blood does not clot
10	The use of living organisms and their biological processes to improve the quality of human life
11	The type of inheritance involving two alleles that are not dominant over one another
12	Characteristics controlled by genes which are located on the sex chromosomes
13	The type of inheritance involving alleles that equally determine the phenotype of heterozygous offspring
14	An allele that is expressed phenotypically only in the homozygous condition
15	The physical and functional expression of a gene
q6	The production of a genetically identical copy of an organism using biotechnology
17	The manipulation of the genetic material of an organism to get desired changes
18	A diagram showing the inheritance of genetic disorders over many generations
19	An allele that does not influence the phenotype when found in the heterozygous condition
20	Organisms having two identical alleles at a given locus
21	An allele that is always expressed in the phenotype
22	An individual having two non-identical alleles for a characteristic
23	A segment of a chromosome that codes for a particular characteristic
24	The type of inheritance which produces an intermediate phenotype
	(24 x1)

Question 3.1

The diagram below shows the inheritance of flower colour in snapdragon plants.

The two alleles controlling flower colour are red (R) and white (W).



- 3.1.1 State the type of dominance shown by the snapdragon plants. (1)
- 3.1.2 Give a reason for your answer to QUESTION 3.1.1. (2)
- 3.1.3 A gardener crossed two pink-flowered snapdragon plants. (6)
- Use a genetic cross to show the ratio of the expected phenotypes in the offspring. (9)

Question 3.2

- 3.2.1 Use a genetic cross to show how gender in human offspring is determined by the sex chromosomes of the parents. (6)
- 3.2.2 Using your knowledge of sex chromosomes, explain why the sex of a child is determined by the male gamete. (5)
- (11)

Question 3.3

Flower colour (purple or white) in a particular plant species is controlled by two alleles, **D** and **d**.

Four crosses were carried out to determine which allele is dominant. Forty (40) offspring were produced in each cross. The phenotypes of the parents and offspring in each cross were recorded.

The results are shown in the table below.

CROSS	PHENOTYPE		
	PARENT 1	PARENT 2	OFFSPRING
1	purple	white	40 purple
2	purple	purple	31 purple, 9 white
3	white	white	40 white
4	purple	white	21 purple, 19 white

- 3.3.1 State the dominant flower colour. (1)
 - 3.3.2 Use cross 1 to explain your answer to QUESTION 3.3.1. (2)
 - 3.3.3 State Mendel's Law of Segregation. (3)
 - 3.3.4 Use a genetic cross to show how the crossing of two purple flowering plants can produce white offspring, as in cross 2. (6)
- (12)**

Question 3.4

In humans, short fingers (**F**) and a widow's peak (**H**) are dominant over long fingers and continuous hairline. A man and a woman, both heterozygous for the two characteristics, plan on having a child.

The table below shows the possible genotypes of the offspring.

Gametes	FH	Fh	fH	fh
FH	FFHH	FFHh	FfHH	FfHh
Fh	FFHh	FFhh	FfHh	Ffhh
fH	FfHH	FfHh	ffHH	Z
fh	FfHh	Ffhh	ffHh	ffhh

- 3.4.1 State the genotype at **Z**. (1)
 - 3.4.2 Give the:
 - (a) genotype of the parents (2)
 - (b) number of genotypes that could result in offspring with short fingers and a continuous hairline (1)
 - (c) allele for a continuous hairline (1)
 - (d) phenotype of a child who is homozygous recessive for both characteristics (2)
- (7)**

Question 3.5

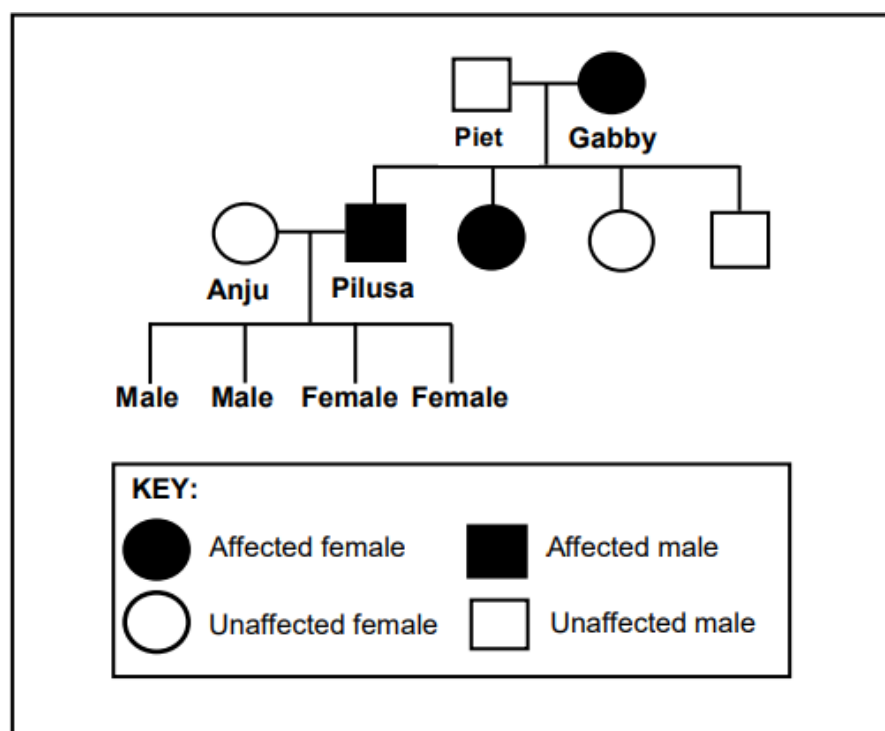
In tomato plants, tall stems (**T**) are dominant over short stems (**t**) and red fruit (**R**) is dominant over yellow fruit (**r**).

A farmer crossed a homozygous tall, yellow tomato plant with a plant that is heterozygous for both characteristics.

- 3.5.1 Name this type of genetic cross. (1)
 - 3.5.2 Give the genotype of a homozygous tall, yellow tomato plant. (2)
 - 3.5.3 List the genotypes of ALL the possible gametes for a plant that is heterozygous for both characteristics. (4)
- (7)**

Question 3.6

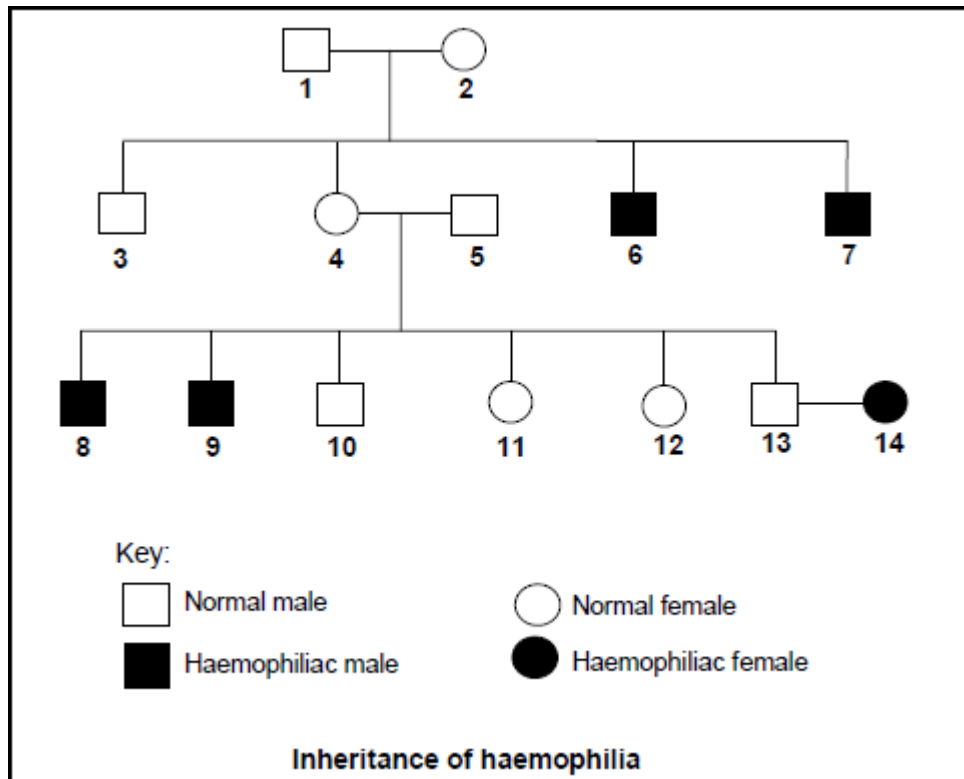
Goltz syndrome is a sex-linked genetic disorder. It is caused by a dominant allele **X**
The diagram below shows the inheritance of Goltz syndrome in a family.



- 3.6.1 Name the type of diagram shown above. (1)
 - 3.6.2 How many:
 - (a) females are in this family? (1)
 - (b) males in the F1-generation have Goltz syndrome? (1)
 - 3.6.3 Give Gabby's genotype. (2)
 - 3.6.4 Anju and Pilusa have four children. Give the phenotype of their sons. (2)
 - 3.6.5 Explain your answer to QUESTION 3.6.4. (4)
- (11)**

Question 3.7

The pedigree diagram below shows the inheritance of haemophilia in a family. The allele causing haemophilia is represented by x^h and the normal allele is represented by x^H



- 3.7.1 Determine the:
- (a) phenotype of individual 4. (1)
 - (b) genotype of individual 2. (2)
- 3.7.2 Explain why females have a smaller chance of suffering from haemophilia. (3)
- 3.7.3 Represent a genetic cross to show the percentage chance of individuals 13 and 14 having a haemophiliac son. (7)
- (13)**

Question 3.8

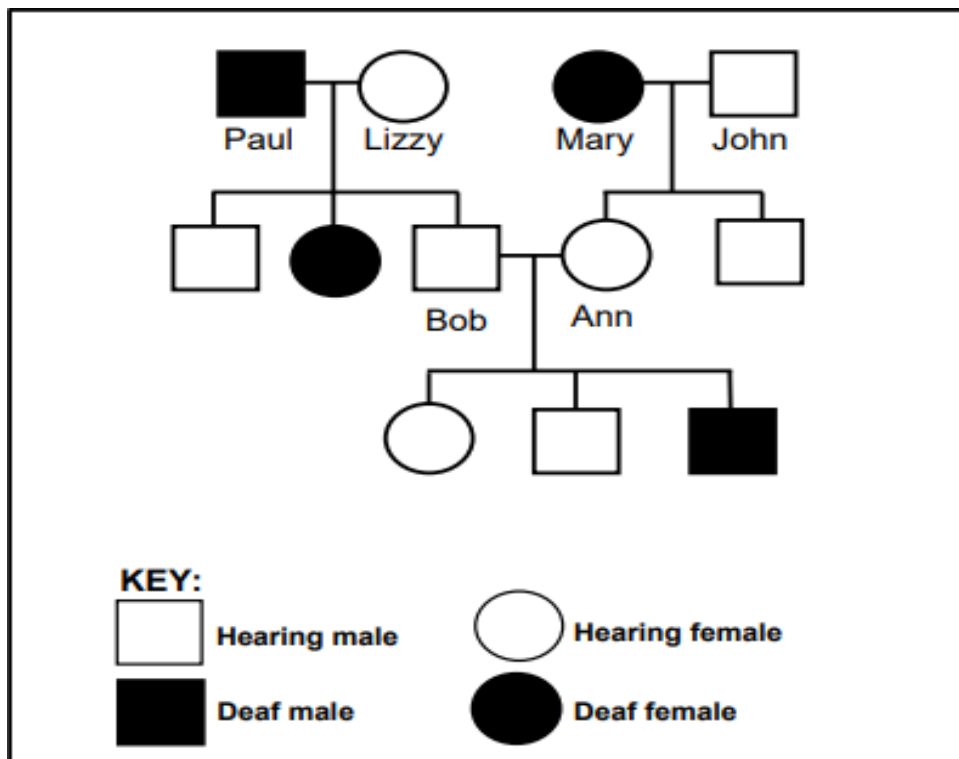
Sickle cell disease is caused by a recessive allele and first appeared in humans as a result of a gene mutation. The table below shows the number of children born with sickle cell disease in some regions in a particular year.

REGION	NUMBER OF CHILDREN BORN WITH SICKLE CELL DISEASE
Democratic Republic of Congo	39 746
United States of America	90 128
Nigeria	91 011
United Kingdom	13 221
Tanzania	11 877
Other	59 750
Worldwide total	305 733

- 3.8.1 What is a gene mutation? (2)
- 3.8.2 Which region had the highest number of children born with sickle cell disease in that year? (1)
- 3.8.3 What percentage of the worldwide total of children born with sickle cell disease came from the Democratic Republic of Congo? Show ALL calculations. (3)
- 3.8.4 Use the letters **D** and **d** to give the genotype of a person who: (1)
- (a) Suffers from sickle cell disease (1)
- (b) Carries the allele but does not suffer from the disease (1)
- (8)**

Question 3.9

One type of deafness in humans is carried on a single allele. The diagram below shows the inheritance of deafness in a family.



- 3.9.1 How many:
- (a) generations are represented in this pedigree diagram? (1)
 - (b) children of Paul and Lizzy are able to hear? (1)
- 3.9.2 Which phenotype is dominant? (1)
- 3.9.3 Use the offspring of Bob and Ann to explain your answer to QUESTION 3.9.2. (4)
- 3.9.4 Use the letter '**A**' to represent the dominant allele and the letter '**a**' for the recessive allele to give ALL the possible genotypes for a hearing individual. (2)
- (9)**

Question 3.10

Read the extract below.

Researchers have discovered that members of a particular family have high bone density that may be caused by a gene mutation. High bone density reduces the risk of bone fractures.

Twenty members of the family had their bone density measured and DNA samples taken. Seven had high bone density. The high bone density occurred throughout their bodies but especially in the spine and hips.

- 3.10.1

From the extract, identify TWO areas in the body where bone density can mainly be measured.

(2)
- 3.10.2

Describe what a gene mutation is.

(2)
- 3.10.3

Explain why it was necessary for the researchers to collect DNA samples.

(2)
- 3.10.4

State the effect of this mutation.

(1)
- 3.10.5

Calculate the percentage of the family members who had normal bone density. Show ALL your workings.

(3)
- (10)**

Question 3.11

The table below shows the blood groups of the members of a family. Two of the children are biological offspring of the parents and one child is adopted.

FAMILY MEMBER	BLOOD GROUP
Father	A
Mother	AB
Daughter	A
Son 1	O
Son 2	B

- 3.11.1

How many:
- (a)

different phenotypes for blood group appear in this family?

(1)
- (b)

possible genotypes are there for blood group AB?

(1)
- 3.11.2

Give the genotype of the father.

(2)
- 3.11.3

Which member of the family:
- (a)

has the genotype ii?

(1)
- (b)

has co-dominant alleles?

(1)
- (c)

is adopted?

(1)
- (7)**

Question 3.12

Human blood groups are controlled by multiple alleles.

- 3.12.1 Name ALL the alleles that control human blood groups. (3)
- 3.12.2 How many of the alleles named in QUESTION 19.1 can any individual inherit? (1)
- 3.12.3 Give a reason for your answer to QUESTION 19.2. (2)
- 3.12.4 A man has blood group **A** and his wife has blood group **B**. Their first child has blood group **AB** and the second child has blood group **O**.
- What can one conclude about the blood groups of their future children? (3)
- (9)

Question 3.13

A man with blood group **AB** and a woman who is heterozygous for blood group **B** plan to have children.

- 3.13.1 How many alleles control the inheritance of blood groups? (1)
- 3.13.2 Describe the type of dominance that occurs in the inheritance of blood group **B** in the woman. (3)
- 3.13.3 Use a genetic cross to show all the possible genotypes and phenotypes of their children. (6)
- (10)

Question 3.14

In humans, haemophilia is caused by a recessive allele on the X-chromosome (x^h). A woman, who is heterozygous for haemophilia, marries a man with haemophilia.

Use a genetic cross to show the percentage chance of the couple having a *daughter* who is homozygous for normal blood clotting. (7)

Question 3.15

Brown enamel of the teeth is a sex-linked trait. A dominant allele on the **X** chromosome causes brown teeth in humans.

- 3.15.1 Explain why more males than females have white teeth. (4)
- 3.15.2 A man with brown teeth married a woman with white teeth.

Use a genetic cross to show the possible phenotypic ratios of their children. Use x^B for brown teeth and x^b for white teeth. (6)

(10)

Question 3.16

The brinjal plant carries edible fruit. Scientists have been studying the inheritance of two genes, one for stem texture and the other for fruit shape.

The stems can be smooth **(N)** or prickly **(n)**, while the fruit shape can be round **(R)** or elongated **(r)**.

- 3.16.1 Name the type of cross that studies two characteristics. (1)
- 3.16.2 State the: (1)
- (a) Dominant characteristic for stem texture (1)
 - (b) Recessive characteristic for fruit shape (1)
- 3.16.3 Give the: (2)
- (a) Genotype of a plant with a prickly stem and elongated fruit (2)
 - (b) Phenotype of a plant with the genotype NnRR (2)
- (7)**

Question 3.17

In rabbits, brown fur **(B)** is dominant to white fur **(b)** and long ears **(E)** is dominant to short ears **(e)**.

A rabbit, that is heterozygous for both characteristics, is crossed with a white rabbit with short ears.

- 3.17.1 Name the type of cross represented. (1)
- 3.17.2 Give the: (2)
- (a) Phenotype of a rabbit that is dominant for both characteristics (2)
 - (b) Genotype of the white rabbit with short ears (2)
 - (c) Genotype of the gametes of a heterozygous brown rabbit with short ears (2)
- (7)**

Question 3.18

Read the extract below.

When a child is born, the umbilical cord is cut and stem cells can be obtained from it. Many people think that the stem cells for treating human conditions should be obtained from umbilical cords, rather than from human embryos.

Recently, stem cells have also been obtained from bone marrow. These stem cells are used to treat conditions such as heart disease and spinal injuries.

- 3.18.1 Name THREE sources of stem cells mentioned in the extract. (3)
- 3.18.2 Explain why the characteristics of stem cells make them useful for treating some disorders. (2)
- 3.18.3 Name ONE condition in the extract that can be treated with stemcells. (1)
- (6)**

Question 3.19

Some horses have straight hair and others have curly hair. A scientist wanted to clone a straight-haired male horse to meet the demand for horses with straight hair.

The scientist used the following procedure:

- The nucleus of a somatic cell was taken from a straight-haired male horse (horse **S**).
- An unfertilised ovum was removed from a curly-haired female horse (horse **T**).
- The nucleus from the somatic cell of horse **S** was placed into the ovum taken from horse **T**.

This ovum was then placed into the uterus of a female surrogate horse (horse **R**).

- 3.19.1 Explain why a somatic cell and NOT a sperm cell from horse **S** would provide the nucleus for the procedure. (3)
- 3.19.2 To which of the three horses (**S**, **T** or **R**) will the cloned offspring be genetically identical? (1)
- 3.19.3 State TWO benefits of cloning. (2)
- (8)**

4. EVOLUTION (GENERAL)

Evolution (54 marks)	Anatomical differences between African apes and humans, with the aid of diagrams, as it applies to the following characteristics: Bipedalism (foramen magnum, spine and pelvic girdle, Brain size, Teeth (dentition), Prognathism, Palate shape, Cranial ridges, Brow ridges. Interpretation of phylogenetic trees
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TERMINOLOGY

Give the correct **biological term** for each of the following descriptions. Write only the term next to the question numbers.

	DESCRIPTION
1	A type of variation where there is a range of phenotype for the same characteristics
2	Present day distribution of living organisms
3	The selection of desirable characteristics by humans
4	The process whereby new species are formed
5	The type of variation in a population with no intermediate phenotype
6	An explanation describing evolution as consisting of long phases of little change alternating with short phases of rapid change
7	The permanent disappearance of species from earth
8	An explanation for something that has been observed in nature and which can be supported by facts, laws and tested hypothesis
9	Organisms with similar characteristics, able to interbreed randomly and produce fertile offspring

10	Structured in different organism that have similar basic plan which suggest that they share common ancestor
11	The process that enable organisms with desirable characteristics to survive and reproduce in that particular environment
12	Remains of life forms preserved in rocks, ice and dried sap trees
13	Change in the characteristics of species over time
14	Large, pointed teeth in African apes that are used for tearing food
15	The part of the skull that houses the brain
16	Having a protruding jaw
17	A diagrammatic representation showing possible evolutionary relationships between different species
18	The opening in the base of the skull through which the spinal cord passes
19	Family to which humans belong
20	An upright posture and walking only on two legs
21	The type of vision shared by apes and humans that allows for depth perception
22	The act of walking on all four limbs
23	Similar structures that are inherited from a common ancestor and are modified for different functions
24	The formation of new species
(24 X 1)	

Question 4.1

Scientists compare the number of differences in the amino acid sequence to see how closely related species are. Fewer differences in the amino acid sequence mean the species are more closely related.

Cytochrome C is a protein that occurs in many species. The amino acid sequence of this protein differs between species.

The table below shows the number of differences in the amino acid sequences of three species, **A**, **B** and **C**.

	SPECIES B	SPECIES C
SPECIES A	11	3
SPECIES B		10

- 4.1.1 What type of evidence for evolution is being used in this table? (1)
- 4.1.2 Give the LETTER of the species, **A**, **B** and **C**, that should appear at positions 1, 2 and 3 in the diagram below. (3)
- (4)

Question 4.2

The fat content of cow’s milk may vary between 2,6% and 5%. A farmer has found that there is a high demand for low-fat milk (milk with a content of 3% or less). He determined the fat content in the milk produced by the cows on his farm.

The results of his survey are given in the table below.

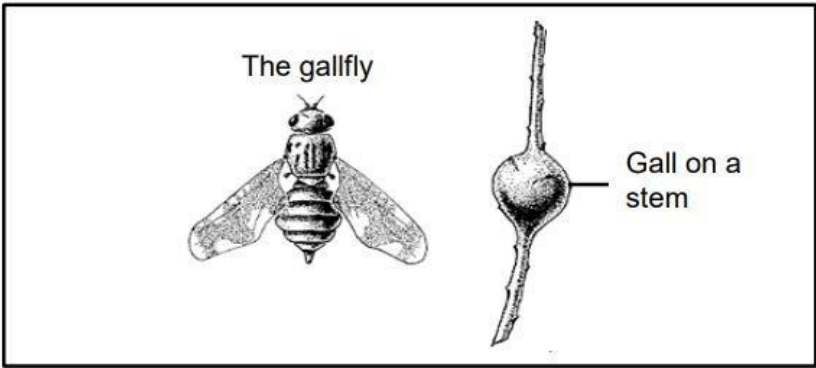
FAT CONTENT (%)	NUMBER OF COWS
2,6 – 3,0	11
3,1 – 3,5	66
3,6 – 4,0	93
4,1 – 4,5	61
4,6 – 5,0	15

- 4.2.1 Draw a histogram to represent the results of the survey. (6)
- 4.2.2 Calculate the percentage of the farmer’s cows that produce low-fat milk. Show All your working. (3)
- 4.2.3 State the type of variation that occurs in the cows, based on the evidence in the table. (1)
- 4.2.4 Give an explanation, for your answer to QUESTION 4.2.3. (1)
- (11)

Question 4.3

Female gallflies lay eggs on the stems of plants. The eggs hatch to form larvae that secrete a substance into the plant tissue. The secretions cause the plant cells to grow and form ball-like structures, called galls, which are high in nutrients. Predatory birds feed on the larvae called galls.

The size of the galls produced actually depends on genetic variation in the gallfly.The diagram bellow shows the gallfly and a gall on a plant stem.



Scientists wanted to investigate whether the size of the galls had an effect on the percentageof the gallfly killed by predatory birds.

The table below shows the results of their investigation.

Gall size	Gallfly larvae killed by predatory birds(mm) (%)
10	1
15	0
20	1
25	2
30	10

- 4.3.1 State the: (1)
 (a) independent variable (1)
 (b) dependent variable (1)
 4.3.2 Give ONE advantage of the gall to the gallfly larvae. (1)
 4.3.3 State why the size of the galls produced is an example of continuous variation (1)
 4.3.4 Draw a line graph to represent the information in the table. (6)
(10)

Question 4.4

Describe the process of natural selection (7)

Question 4.5

Explain why modern day Spider monkeys all have long tails whereas ancestors of Spider monkeys had much shorter tails using:

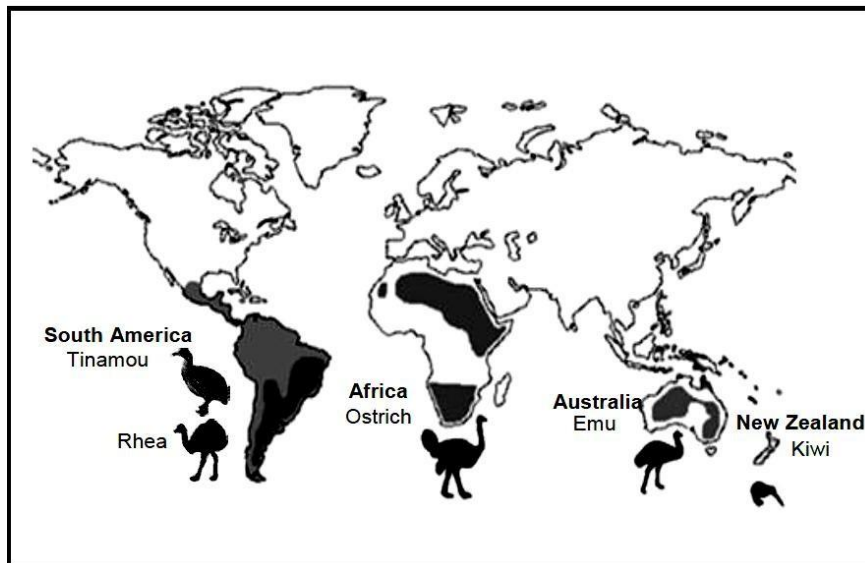
- 4.5.1 Lamarck's theory (6)
 4.5.2 Darwin's theory (8)
(14)

Question 4.6

Tabulate THREE differences between Lamarckism and Darwinism (7)

Question 4.7

Flightless bird species that are currently distributed across different continents are shown in the picture below



Scientists hypothesize that these species of flightless birds arose from a single common ancestor that was able to fly.

- 4.7.1 Describe how Lamarck would have explained the evolution of flightless birds (4)
- 4.7.2 Name THREE reproductive isolation mechanisms that keep species separate (3)
- (7)

Question 4.8

Male long-tailed widowbirds have extremely long tail feathers that they use in mating to attract females.

Scientist conducted, an investigation to determine the relationship between the length of the male long-tailed widowbird's tail and its mating success.

The procedure was as follows:

- A total of 27 male long-tailed widowbirds was sampled and divided into 3 groups
- The tail feathers of the birds in each group were treated in the following way:
 - Group 1 – Cut short
 - Group 2 – Made longer by adding artificial feathers
 - Group 3 – Left unchanged
- The 3 groups of male long-tailed widowbirds, along with female long-tailed widowbirds, were released into an environment suitable for mating.
- Each time a pair mated successfully they produced a nest, and all the nests were counted.
- The average number of nests produced by each group was calculated and used as an indication of mating success.

The results are shown in the table below.

GROUP	AVERAGE NUMBER OF NESTS PRODUCED
1	0,5
2	2,5
3	1

- 4.8.1 Name the:
- (a) reproductive isolating mechanism that occurs in long-tailed widowbirds. (1)
 - (b) independent variable in this investigation. (1)
- 4.8.2 Explain why 27 long-tailed widowbirds were used in the investigation instead of only 3. (2)
- 4.8.3 Explain why Group 3 was included in the investigation (2)
- 4.8.4 Draw a bar graph to represent the results of this investigation (6)
- 4.8.5 State a conclusion for this investigation (2)
- (14)**

Question 4.9

A group of students observed that the mating calls of a population of frogs at the local dam has recently become much louder. The dam is close to a highway where traffic noise has increased over the years.

They wanted to investigate if the increase in the increase in traffic noise from the highway had an evolutionary effect on the loudness of the frogs mating calls in the mating season.

They recorded the following:

- Average level of traffic noise over a period of 6 years.
- Average loudness of the frogs mating calls during the same period

The results are shown in the table below

YEAR	AVERAGE LOUDNESS OF TRAFFIC NOISE (bD)	AVERAGE LOUDNESS OF MATING CALLS (dB)
2006	30	36
2007	32	38
2008	36	40
2009	40	48
2010	55	68
2011	62	74

- 4.9.1

Explain the advantages of a louder mating calls.

(2)
- 4.9.2

State why these results may be considered to be reliable.

(1)
- 4.9.3

State a conclusion for this investigation.

(2)
- 4.9.4

Give TWO variables that should be kept constant in this investigation

(2)
- 4.9.5

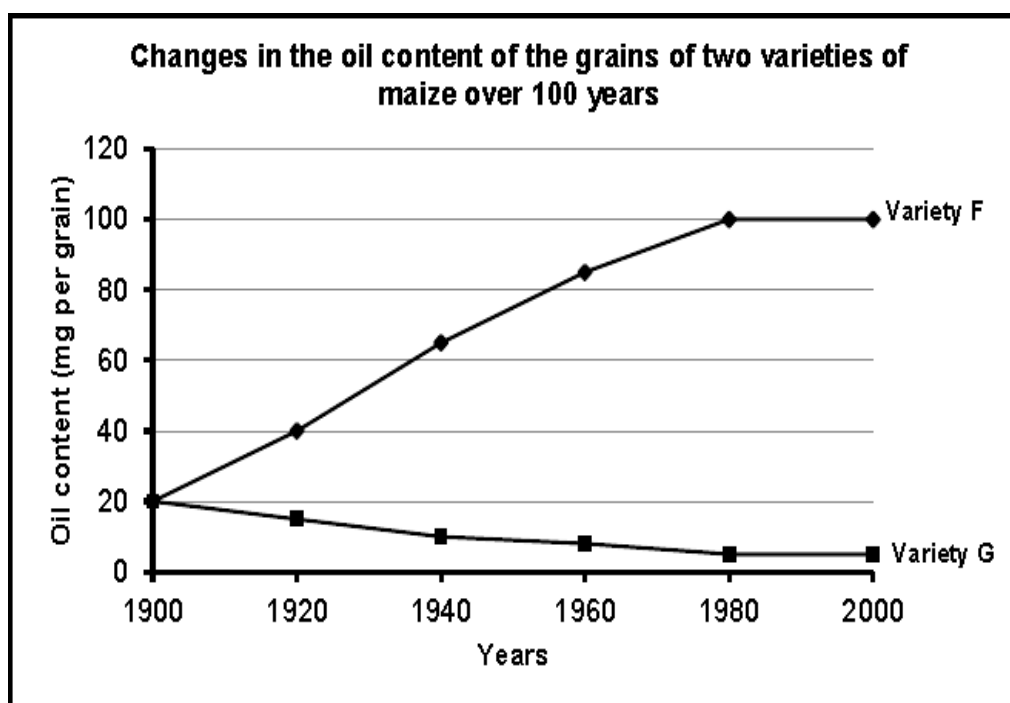
Draw line graphs on the same set of axes to show the change in average loudness of traffic noise and mating calls for the period 2006 to 2009

(7)
- (14)**

Question 4.10

Artificial selection programme have produced two varieties of maize. One has grains with a high oil content (Variety F) and the other has grains with a low oil content (variety G)

The graph below shows the changes in the oil content of the grains of the two varieties over 100 years of artificial selection.



- 4.10.1 In which year did the two maize varieties have the same oil content? (1)
- 4.10.2 Calculate the percentage increase in the oil content of Variety F over the 100-year period. Show ALL working. (3)
- 4.10.3 Tabulate TWO differences between natural selection and artificial selection. (5)
- (9)**

Question 4.11

Read the extract below.

The red-bellied black snake (*Pseudechis porphyriachus*) and the green tree snake (*Denderelaphis punctulatus*) are predators that sometimes feed on cane toads (*Bufomannus*) that contain a toxin that may kill them.

The snakes consume the loads by swallowing them whole. A decrease in the average jaw size has been observed over a period of 70 years. Some scientists believe that this may be an example of punctuated equilibrium. With this change it was also noted that the snakes could no longer swallow the large cane toads. This has resulted in an increase in the survival of the snakes

- 4.11.1 Define *punctuated equilibrium*. (3)
 - 4.11.2 What characteristic of the toad species protects it from predation? (1)
 - 4.11.3 Explain how the change in jaw size helped the snakes to survive. (3)
 - 4.11.4 How would the Lamarck have explained the development of small jaw size in the snakes? (4)
- (11)**

Question 4.12

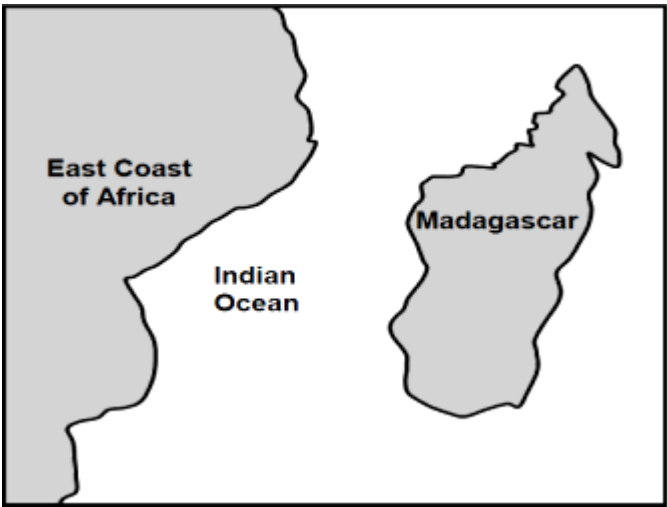
Describe speciation through geographical isolation

(6)

Question 4.13

Pottos and lemurs are small mammals. Scientists believe that pottos and lemurs share a common ancestor that existed in Africa. Presently pottos only occur in Africa while lemurs are only found in Madagascar.

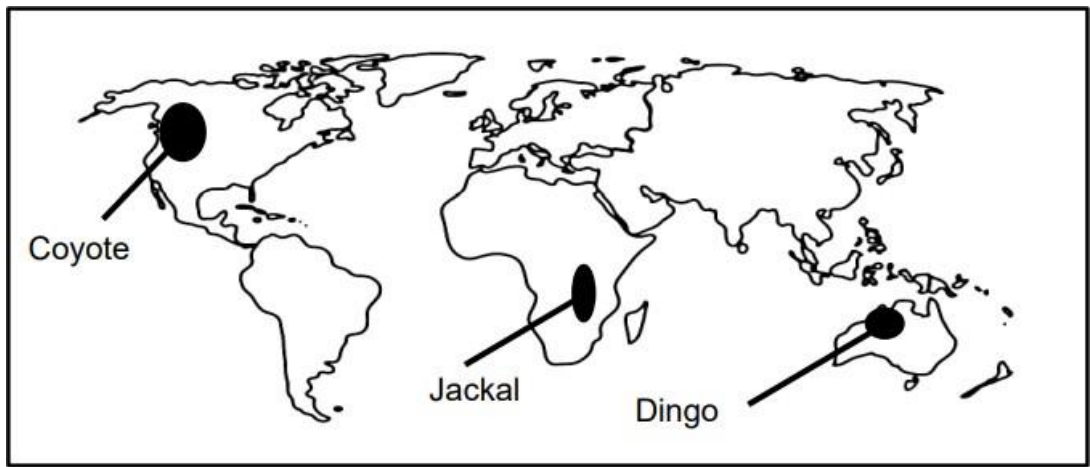
Madagascar is an island off the East of Africa as shown in the diagram below.



- 4.13.1 Explain how continental drift could have affected the distribution of the common ancestor (4)
 - 4.13.2 Describe the speciation of the pottos and lemurs to become different (6)
- (10)**

Question 4.14

The present –day distribution of three closely related species of the dog family, the coyote , jackal and dingo , is shown on the world map below.



- 4.14.1 What type of evidence for evolution is represented here? (1)
- 4.14.2 What is a biological species? (3)
- 4.14.3 Describe how these three species could have evolved from a common ancestor (7)
- (11)

Question 4.15

Modern-day whales are aquatic mammals, spending their entire lives in the ocean. They are thought to have evolved from four-legged ancestors, as represented below.

SPECIES	EXISTENCE ON EARTH	CHARACTERISTICS
<i>Pakicetus</i> 	50 mya	Quadrupedal carnivore
<i>Ambulocetus</i> 	48 mya	Flipper-like large feet and tail for swimming
<i>Dorudon</i> 	40 mya	Large flippers in front and very small hind limbs
<i>Balaena</i> (Blue whale) 	Present day	Non-functioning pelvis and large flippers in front

- 4.15.1 Which ancestor of whales most likely lived both in water and on land? (1)
 - 4.15.2 Give ONE reason for your answer to QUESTION 4.15.1. (2)
 - 4.15.3 Explain why Ambulocetus and Dorudon may be considered as transitional species in the evolution of whales. (2)
 - 4.15.4 Explain, according to Lamarck, why modern-day whales do not have legs. (3)
- (8)**

Question 4.16

Read the extract below

Samango and vervet are two species of monkeys that occupy the same habitat. Researchers have recently discovered that a population of samango monkeys were able to interbreed with vervet monkeys to produce offspring. These offspring were infertile.

- 4.16.1 Define the term population. (3)
 - 4.16.2 Give ONE reason why samango and vervet monkeys are considered to be two different species. (1)
 - 4.16.3 List THREE mechanisms of reproductive isolation that are NOT mentioned above. (3)
- (7)**

Question 4.17

Dogs have been selected and bred over many years to produce approximately 340 different dog breeds. They have been bred for certain characteristics desirable to humans.

An analysis of 736 base pairs of the cytochrome-b gene showed that grey wolves are the only direct ancestor to present-day dog breeds. All dog breeds belong to the species *Canis familiaris*.

The table below shows some dog breeds and their desirable characteristics.

Grey wolf	Dog breeds	Characteristics
	 Poodle	Intelligent
	 Pug	Loving, affectionate and playful
	 Saint Bernard	Outgoing and adventurous
	 Rhodesian ridgeback	Strong, athletic and fast

- 4.17.1

Name the process whereby the different breeds of dogs were produced.

(1)
- 4.17.2

Describe how humans carried out the process named in QUESTION 7.1.

(3)
- 4.17.3

Explain how it can be confirmed that all these dog breeds belong to the same species.

(2)
- 4.17.4

Explain which of the dog breeds shown would best be used for hunting.

(2)
- 4.17.5

Explain how present-day dog breeds may be disadvantaged in relation to their common ancestor

(3)
- (11)

Question 4.18

Patients infected with the HI virus (HIV) are treated with antiretroviral drugs. When they miss their treatment, it can increase the chances (probability) of the virus developing resistance to the drug.

Scientists conducted an investigation to determine the effect of the number of missed treatments on the probability of the HI virus developing resistance to antiretroviral drugs.

The results are shown in the table below.

Number of missed treatments (in days)	Probability of the HI virus developing resistance to antiretroviral drugs (%)
2	0
7	20
14	35
21	40
37	60

- 4.18.1 State the following for this investigation: (1)
(a) The dependent variable (1)
(b) The independent variable (1)
- 4.18.2 Based on the results, state ONE precaution for patients receiving antiretroviral treatment. (1)
- 4.18.3 State a conclusion for this investigation. (2)
- 4.18.4 Describe the evolution of resistance to antiretroviral medication in the HI virus. (5)
(10)

Question 4.19

There are anatomical differences between African apes and humans. There are also characteristics that they share.

- 4.19.1 Name ONE characteristics of the hand that African apes share with humans. (1)
- 4.19.2 Tabulate THREE differences between the skulls of African apes and humans. (7)
- 4.19.3 Give TWO characteristics of the pelvis of a bipedal organism. (2)
(10)

Question 4.20

Humans are bipedal organisms.

- 4.20.1 What is meant by bipedalism? (2)
- 4.20.2 Explain how each of the following skeletal structures have contributed to bipedalism in humans: (2)
- (a) Foramen magnum (2)
 - (b) Pelvic girdle (2)
 - (c) Spine (2)
- (8)**

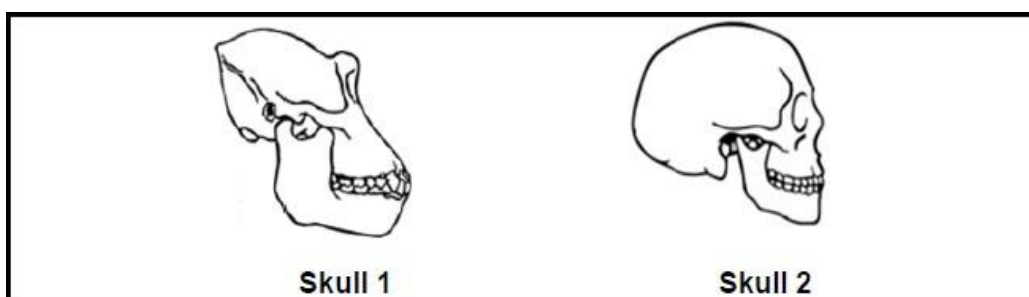
Question 4.21

Scientists find evidence for human evolution by comparing humans to other hominids. The upper limbs of humans and African apes show similar characteristics, whereas there are differences between the dentition (teeth) of the two.

- 4.21.1 Why do scientists look for similarities between humans and African apes? (1)
- 4.21.2 Explain the importance of the positioning of the thumbs for humans and African apes. (2)
- 4.21.3 State ONE difference between the teeth of humans and African apes. (2)
- (5)**

Question 4.22

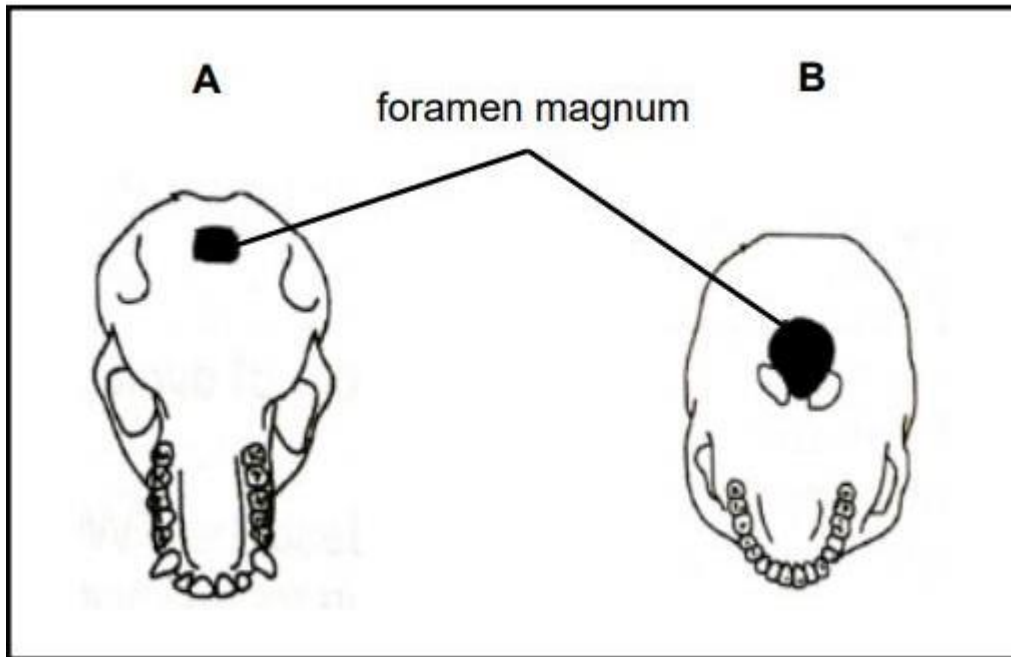
The diagrams below show the skulls of two species of primates.



- 4.22.1 Tabulate THREE observable differences between skull 1 and skull 2 that show trends in human evolution. (7)
- 4.22.2 Give FOUR characteristics of the upper limbs that humans share with other primates. (4)
- 4.22.3 Explain how an increase in cranial volume is related to intelligence. (3)
- (14)**

Question 4.23

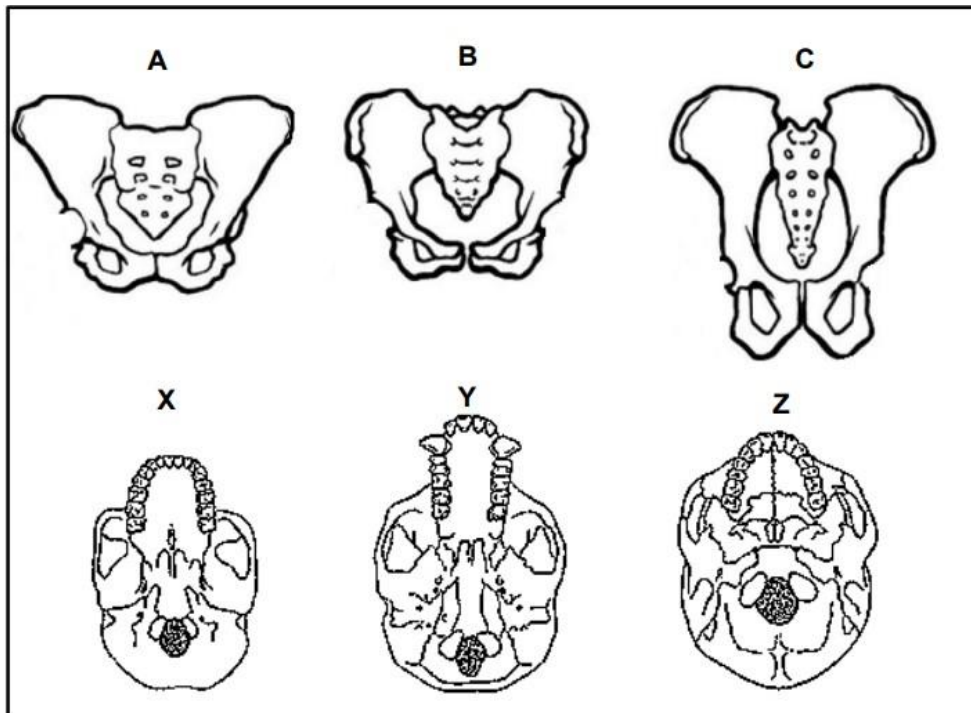
Diagram **A** and **B** show the ventral (bottom) view of the skulls of two organisms. The diagrams are NOT drawn to scale.



- 4.23.1 Which diagram represents the skull of a bipedal organism? (1)
- 4.23.2 Give ONE visible reason for your answer to QUESTION 4.23.1. (2)
- 4.23.3 Tabulate TWO visible differences between the upper jaws in the diagrams **A** and **B** that represents trends in human evolution. (5)
- 4.23.4 Explain the significance of the shape of the spine that is associated with the skull in diagram **B**. (2)
- (10)**

Question 4.24

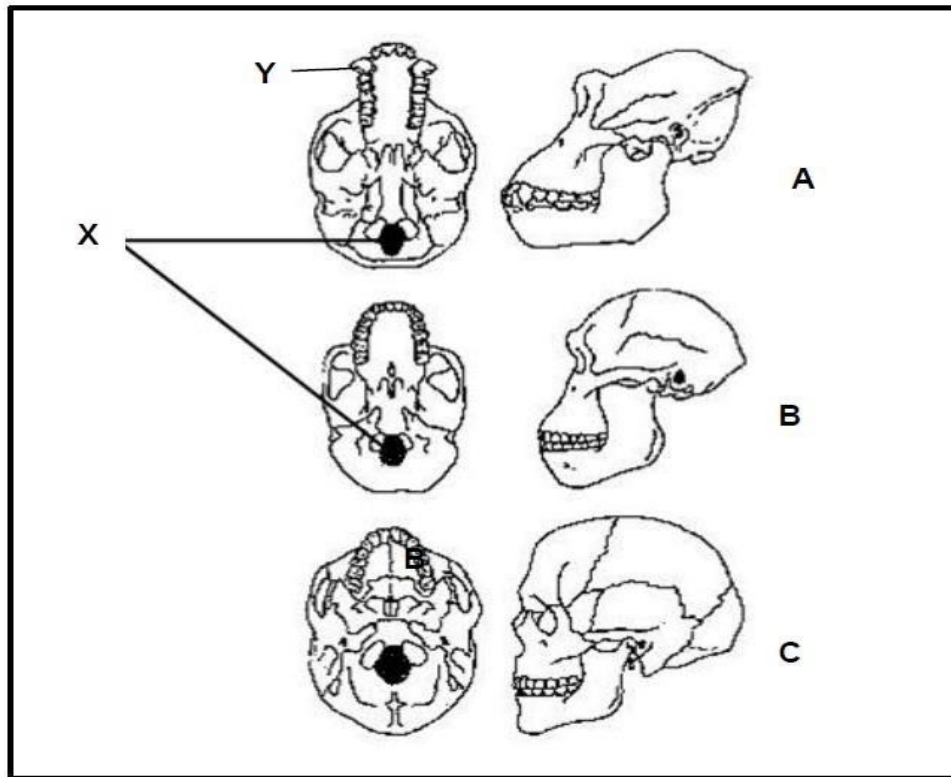
The diagram below represents the pelvic structure and the ventral view of the skulls of three organisms. The diagrams are drawn to scale



- 4.24.1 Write down the LETTER(S) if the diagram(s) that represent the: (2)
(a) Skulls of bipedal organisms (2)
(b) Pelvic structure of a quadrupedal organism (1)
- 4.24.2 Give a reason for your answer to QUESTION 4.24.1(b). (2)
- 4.24.3 Describe ONE other structural difference between a bipedal and a quadrupedal organism. (3)
- (8)**

Question 4.25

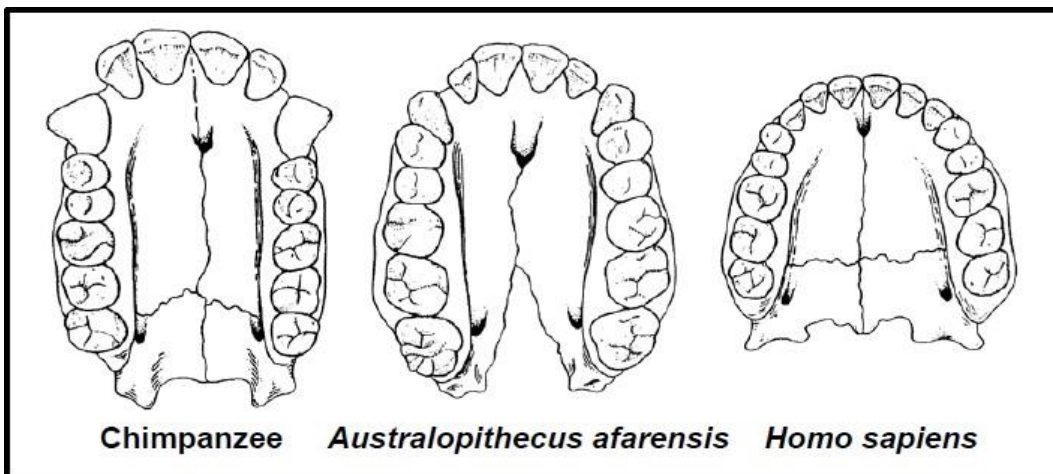
The diagram below represents the fossilised skulls of three different species of primates. They were either bipedal or quadrupedal (organisms that habitually walk on all four limbs).



- 4.25.1 Label part **X** and the type of teeth at **Y**. (2)
- 4.25.2 Explain the significance of the location of structure **X** in organism **C**. (3)
- 4.25.3 Which of the skulls (**A**, **B** or **C**) belong to:
- (a) An *Australopithecine* (1)
 - (b) A quadrupedal primate (1)
- 4.25.4 Explain how the change in the skull from B to C could indicate a change in intelligence. (3)
- (10)**

Question 4.26

The diagrams below show the upper jaws of some fossils. These diagrams are drawn to scale.



- 4.26.1 Describe ONE visible difference between the jaw of a chimpanzee and that of *Homo sapiens* which show trends in human evolution. (2)
 - 4.26.2 Based on the differences in dentition, what conclusion can be made about the change in diet from *Australopithecus afarensis* to *Homo sapiens*? (2)
 - 4.26.3 *Australopithecus* may be described as a transitional species between the chimpanzee and *Homo sapiens*.
 - (a) Define a transitional species. (1)
 - (b) Use ONE visible feature of the jaw to explain why *A. afarensis* may be described as a transitional species. (2)
- (7)**

Question 4.27

The table below shows information on selected hominid fossils.

Common name of the fossil	Species	Fossil site	Scientist responsible for discovery
P	Australopithecus sediba	Malapa Cave in the Cradle of Humankind	Q
Taung Child	R	Sterkfontein Caves	S

- 4.27.1 Name fossil **P**. (1)
- 4.27.2 Identify the species at **R**. (1)
- 4.27.3 Give the name of the scientist at:
- (a) **Q** (1)
- (b) **S** (1)
- (4)**

Question 4.28

The table shows the evolution of cranial capacity in some species.

SPECIES	PERIOD OF EXISTENCE (MILLION YEARS AGO)	AVERAGE CRANIAL CAPACITY (CM ³)
<i>Sahelanthropus</i>	7,0-6,0	450
<i>Australopithecus afrecanus</i>	3,0-2.0	480
<i>Homo habilis erectus</i>	2.2-1,6	650
<i>Homo erectus</i>	2.0-0.4	900
<i>Homo neanderthalensis</i>	0.4-0.04	1500
<i>Homo sapiens</i>	0.2-0	1450

4.28.1 Name:

- (a) Two hominid genera in the table above (2)
- (b) Two fossils of *A. africanus* that were found in South Africa (2)
- (c) The genus that appeared first on Earth as shown in the table (1)

4.28.2 Which hominid had a cranial capacity closest to that of *Homo sapiens*? (1)

4.28.3 Give the smallest cranial capacity (in cm³) of a Homo species. (1)

4.28.4 When did *Australopithecus africanus* become extinct? (1)

4.28.5 Fossils are used as evidence of hominid evolution.

Name TWO other lines of evidence. (2)
(10)

Question 4.29

4.29.1 State the 'Out of Africa' hypothesis. (2)

4.29.2 Name the family to which modern humans belong. (1)

4.29.3 What genetic evidence is used to support the 'Out of Africa' hypothesis? (1)

4.29.4 Describe how fossil evidence is used to support the 'Out of Africa' hypothesis. (4)

(8)

Question 4.30

Fossil evidence is used to support the 'Out-of-Africa' hypothesis.

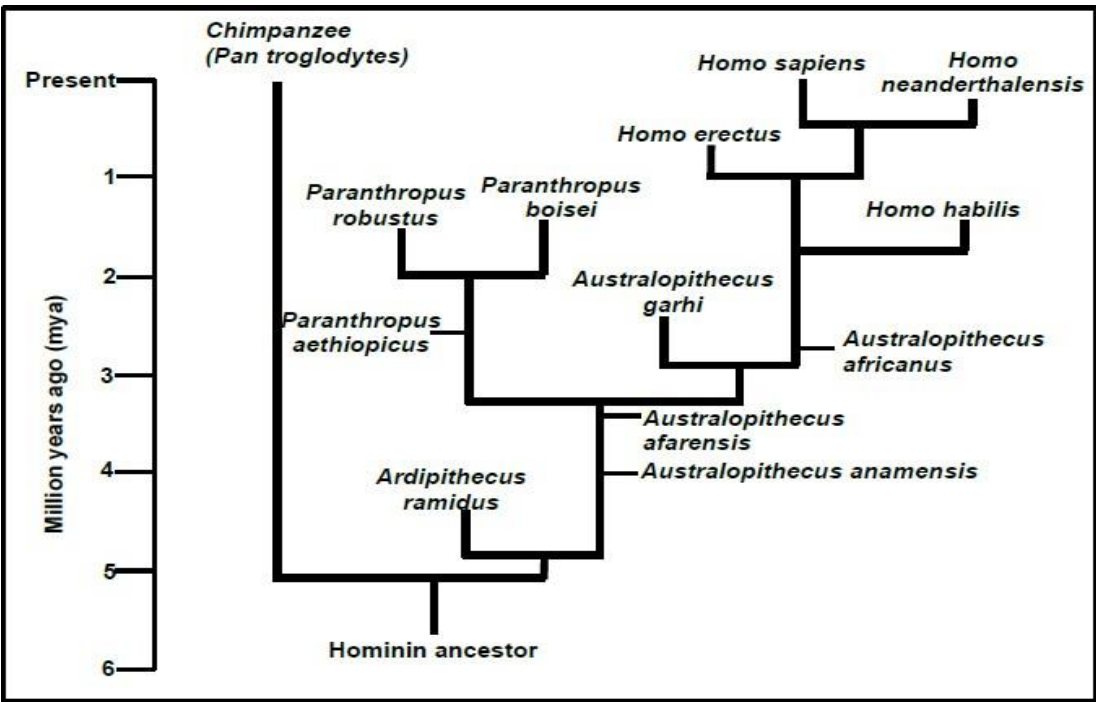
4.30.1 State the 'Out-of-Africa' hypothesis. (2)

4.30.2 Describe how fossil evidence is used to support 'Out-of-Africa' hypothesis. (6)

(8)

Question 4.31

The diagram below shows possible evolutionary relationships among some hominids.



- 4.31.1

What is this type of diagram called?

(1)
- 4.31.2

How many of EACH of the following are represented in the diagram:
- (a)

Genera

(1)
- (b)

Homo species

(1)
- 4.31.3

Name the species that have *Paranthropus aethiopicus* as a common ancestor.

(2)
- 4.31.4

When did:
- (a)

Ardipithecus ramidus become extinct

(1)
- (b)

Homo erectus first appear

(1)
- 4.31.5

Name the:
- (a)

Hominid species that existed at the same time as *Homo sapiens*.

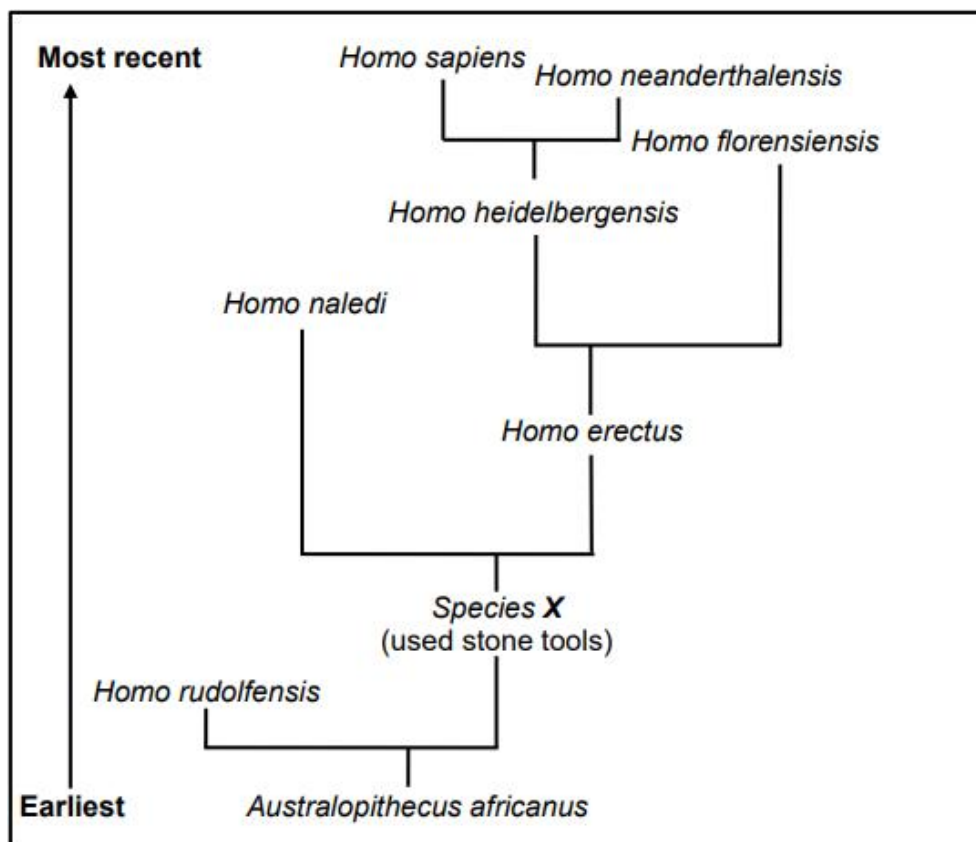
(1)
- (b)

First Homo species to use tools

(1)
- (9)

Question 4.32

The diagram below represents one model of the evolution of some hominids.



- 4.32.1 Identity the type of the diagram shown. (1)
 - 4.32.2 How many genera are represented by the diagram? (1)
 - 4.32.3 Name the speciaces:
 - (a) Represented by **X** on the diagram (1)
 - (b) That shares a common ancestor with Homo erectus (1)
 - 4.32.4 Which species of the genus Homo is the only one in existence today? (1)
 - 4.32.5 Name TWO forms of evidence that would have been used to support the information in the diagram . (2)
 - 4.32.6 The average cranial capacity of Homo sapiens is 1500 cm³ compared to 520 cm³ in Australopithecus africanus. (3)

Explain the significance of the difference in cranial capacity.
 - 4.32.7 Explain how the fossils of Australopithecus africanus, Species **X** and Homo erectus are used to support the 'Out of Africa' hypothesis. (4)
- (14)**