Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2016

LIFE SCIENCES P2

MARKS: **150**

TIME: **2½ hours**

LFSCE2

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 EACH question on a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. ALL drawings MUST be done in pencil and labelled in blue or black ink.
7. Draw diagrams, tables or flow charts ONLY when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. Do NOT use graph paper.
10. You must use a non-programmable calculator, protractor and a compass, where necessary.
11. Write neatly and legibly.

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question number (1.1.1–1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 The first primate to use tools consistently was …

A *Homo erectus.*
B *Homo habilis.*
C *Homo floresiensis.*
D *Homo neanderthalensis.*

1.1.2 The average brain size in cubic centimeters of a modern human is …

A 400–500
B 800–1 000
C 100–200
D 1 300–1 400

1.1.3 During translation, the type of amino acid that is added to the growing polypeptide depends on the …

A codon on the mRNA only.
B anticodon on the tRNA to which the amino acid is attached only.
C codon on the mRNA and the anticodon on the tRNA to which the amino acid is attached.
D anticodon on the mRNA only.

1.1.4 How many nitrogenous bases form a codon?

A 9
B 12
C 3
D 6

1.1.5 Cows that give more milk than other cows are an example of …

A natural selection.
B natural variation.
C struggle for existence.
D survival of the fittest.

1.1.6 In an investigation it was found that 10% of the nitrogenous bases in a molecule of DNA was thymine. What was the ratio of thymine to guanine in the same molecule?

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

1.1.7 When a red horse (RR) is crossed with a white horse (WW), the offspring are all roan (RW = red and white hairs together). This type of inheritance is known as …

A codominance.
B polygenic inheritance.
C multiple alleles.
D incomplete dominance.

1.1.8 Study the table below showing various amino acids coded for by various mRNA codons.

mRNA codons	Corresponding amino acids
GCG	Alanine
AUG	Methionine
AUA	Isoleucine
AGG	Arginine

Which amino acid is coded by the DNA triplet of nitrogenous bases TAC?

A alanine
B arginine
C isoleucine
D methionine

1.1.9 In mice brown fur coat is dominant to white fur coat. If a heterozygous brown mouse is mated with a white mouse and 8 offspring are produced, how many would be expected to be white?

A 4
B 8
C 0
D 2

1.1.10 Which of the following is usually NOT possible for red-green colour blindness?

A A carrier mother passes the allele on to her daughter.
B A colour blind father passes the allele on to his daughter.
C A colour blind father passes the allele on to his son.
D A carrier mother passes the allele on to her son.

(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 (1.2.1–1.2.9) in the ANSWER BOOK.

1.2.1 A segment of DNA coding for a particular characteristic

1.2.2 Bond joining amino acids in a protein

1.2.3 Synthesis of mRNA from DNA

1.2.4 Structure which joins the chromatids of a chromosome

1.2.5 Chromosome condition describing the presence of a single set of chromosomes in a cell

1.2.6 The physical / functional expression of an organism's genes

1.2.7 Allele that is only expressed in the homozygous state

1.2.8 Having more than two different alleles for the same gene

1.2.9 The process by which different kinds living organisms are believed to have developed from earlier forms during the history of the earth

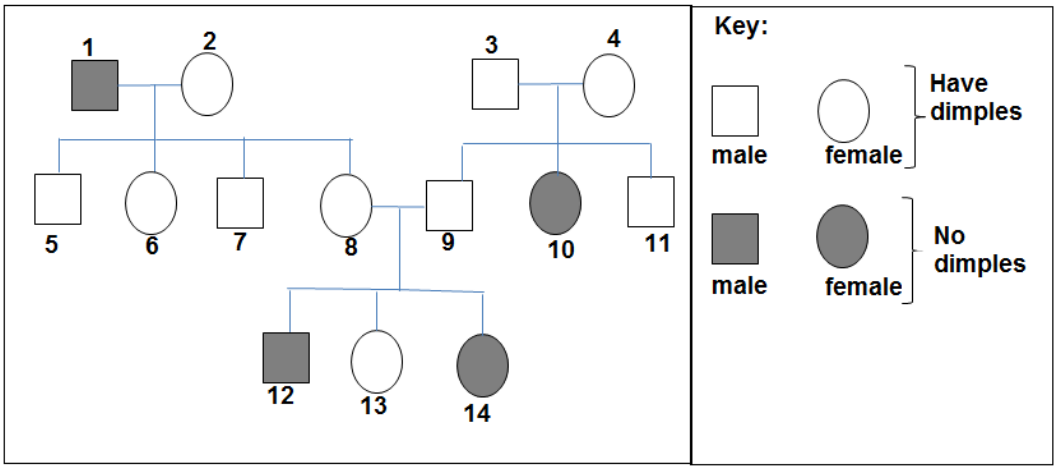
(9 x 1) (9)

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 number in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	A pair of chromosomes with the same shape and size	A: Homozygous B: Heterozygous
1.3.2	Phase during which chromatids are pulled to opposite poles	A: Anaphase 1 B: Anaphase 2
1.3.3	Scientist(s) who used X-rays to work out the shape of DNA	A: Wilkins B: Franklin

(3 x 2) (6)

1.4 Use the pedigree diagram below to answer the questions about dimples (small depressions that occurs on the cheeks when one smiles).
The dimple gene (D) controls whether a person has dimples or does not have dimples. Allele for having dimples is dominant to allele for not having dimples (d).



1.4.1 How many family members have dimples? (1)

1.4.2 What is the genotype of the individuals?

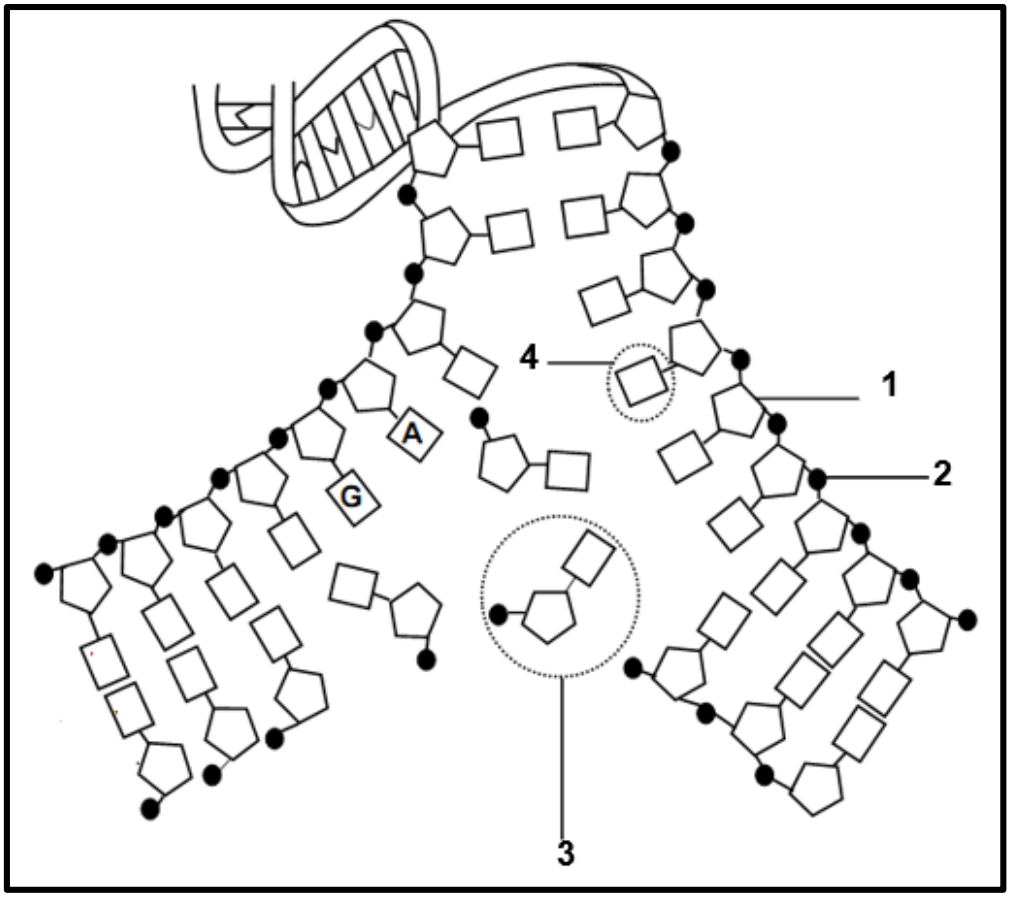
(a) 3 (1)
(b) 4 (1)

1.4.3 State whether the following individuals are homozygous or heterozygous for having dimples:

(a) 2 (1)
(b) 9 (1)

1.4.4 State the family relationship between individual 12 and individual 2. (2)

1.5 Study the diagram below and answer the questions that follow.



1.5.1 Name the process illustrated in the diagram. (1)

1.5.2 State the significance of the process mentioned in QUESTION 1.5.1. (2)

1.5.3 Identify the parts labelled:

(a) 1 (1)
(b) 2 (1)
(c) 3 (1)
(d) 4 (1)

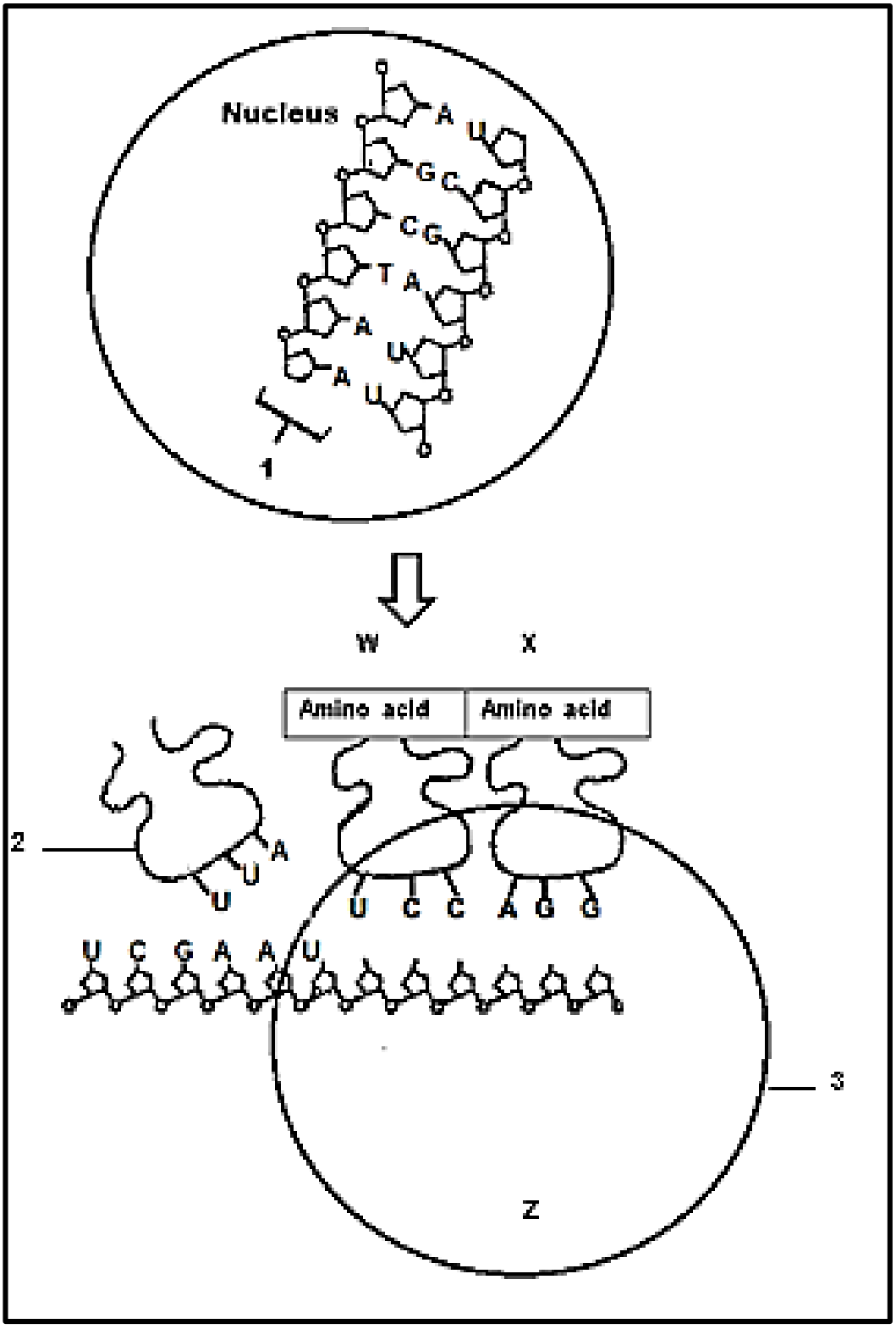
1.5.4 Give ONE location in cells other than in the nucleus where DNA can be found. (1)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagrams below represent the process of protein synthesis. Study them and answer the questions that follow.



2.1.1 Identify the structures labelled **1**, **2** and **3**. (3)

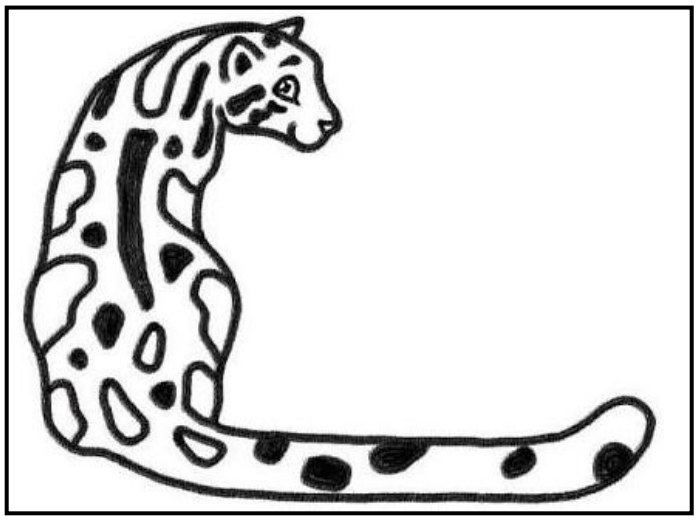
2.1.2 Name and describe the stage of protein synthesis taking place at **Z**. (5)

2.1.3 Using the table below, work out the names of amino acids labelled **W** and **X** using the table.

Base Triplet on mRNA coding for the amino acid	Amino acid coded for
GAG	Glutamate
CAG	Histidine
AGG	Arginine
CUG	Leucine
UCC	Proline
GUG	Valine

(4)

2.2 Clouded leopards (Neofelis nebulosa) are a medium-sized, endangered species of cat, living in the very wet cloud forests of Central America. The normal spots (X^N, pictured here) are a result of a dominant, sex-linked allele and that dark spots are the result of a recessive allele.
A biologist crossed a male with dark spots and a female with normal spots. She had four cubs; two are male and two female. One of each of the male and female cubs have normal spots and one each have dark spots.

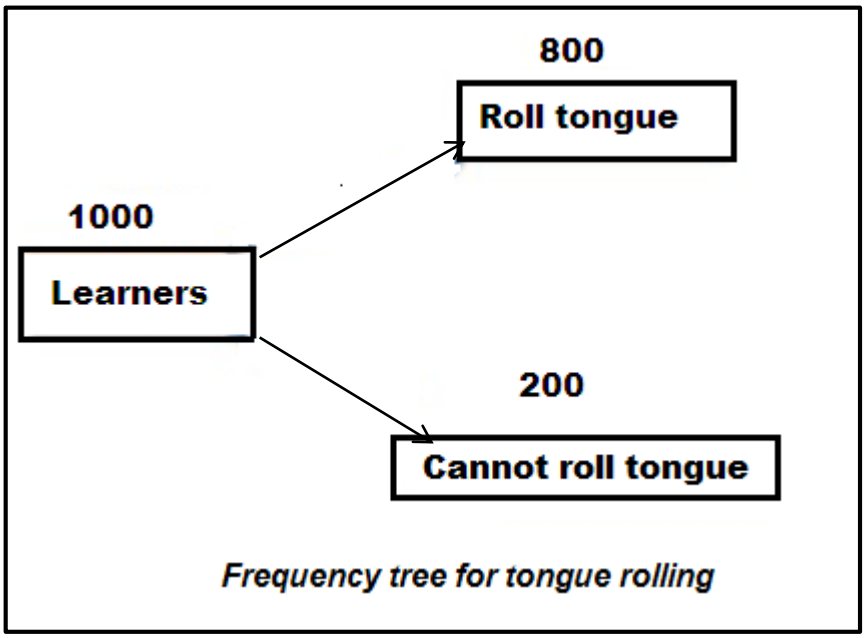


2.2.1 What is the genotype of the mother? (2)

2.2.2 The biologist crosses the female cub that is heterozygous for normal spots, with a male that also has normal spots. Using a genetic cross determine how many of each phenotype will be found in the cubs, assuming that 4 cubs are born and two are males and two are females. (6)

2.2.3 Calculate the percentage of dark spotted males among the offspring. SHOW ALL WORKING. (2)

2.3 A class of Grade 11 learners conducted an investigation to determine the frequency of dominant and recessive characteristics in their school. The characteristic investigated was the ability to roll one's tongue.
The results obtained were recorded in the frequency tree as shown below.



Frequency tree for tongue rolling

2.3.1 Based on the results obtained from this investigation, which characteristic is dominant? (1)

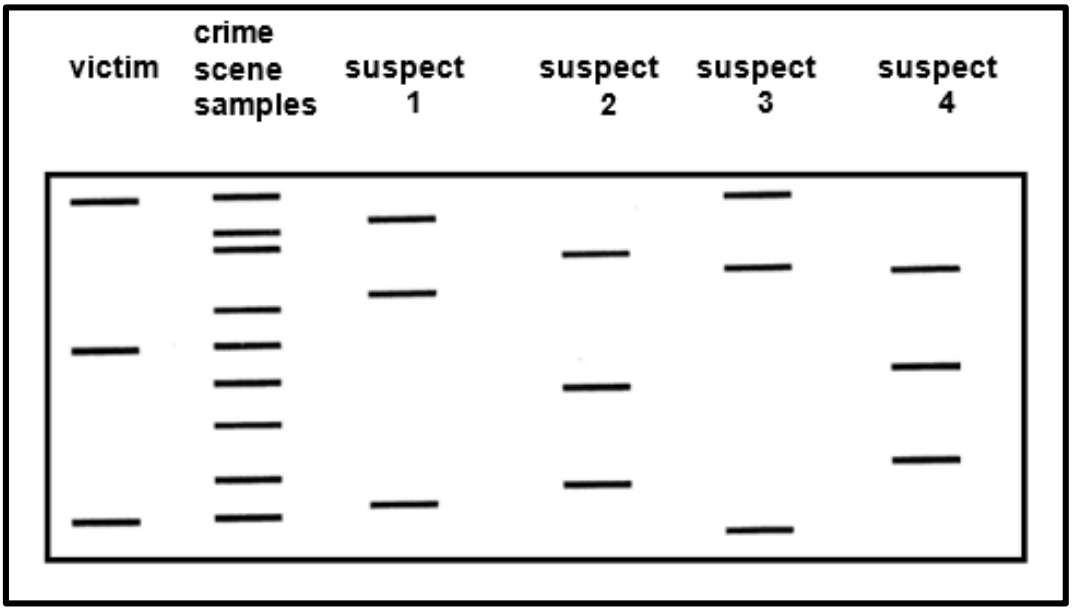
2.3.2 List THREE steps that the learners need to follow while planning this investigation. (3)

2.3.3 Use the data given in the frequency tree to plot a bar graph. (6)

2.3.4 Would you classify the ability to roll one's tongue as continuous or discontinuous variation? (1)

2.3.5 Explain your answer to QUESTION 2.3.4. (2)

2.4 During a fight involving a number of people, one person was seriously injured. Blood samples were taken from the victim, the crime scene and four suspects. DNA was extracted from each of the blood samples and the results are shown in the DNA profiles below.



2.4.1 Which suspect was probably involved in injuring the victim? (1)

2.4.2 Give a reason for your answer in QUESTION 2.4.1. (1)

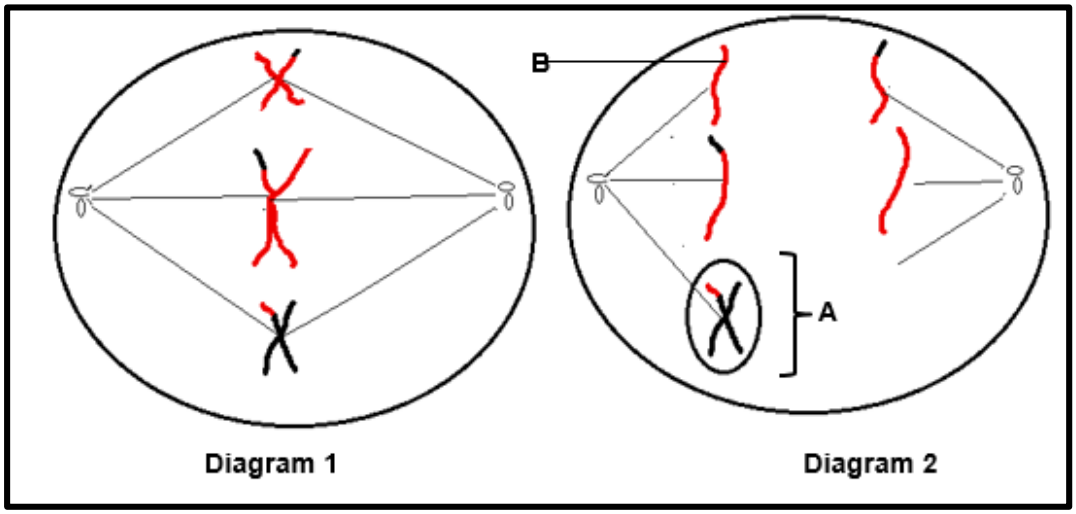
2.4.3 List ONE application of DNA profiling other than for solving crime. (1)

2.4.4 Explain TWO reasons why sometimes DNA profiling can prove to be controversial (i.e. cause people to disagree with the results). (2)

[40]

QUESTION 3

3.1 Study the diagrams below representing two phases of meiosis and answer the questions that follow.



3.1.1 Identify the phases represented by:

(a) Diagram **1** (1)
(b) Diagram **2** (1)

3.1.2 Name part labelled **B.** (1)

3.1.3 Describe what happens during the phase illustrated in Diagram **1**. (2)

3.1.4 In Diagram 2 the part circled and labelled **A,** is an abnormality during the process of meiosis.

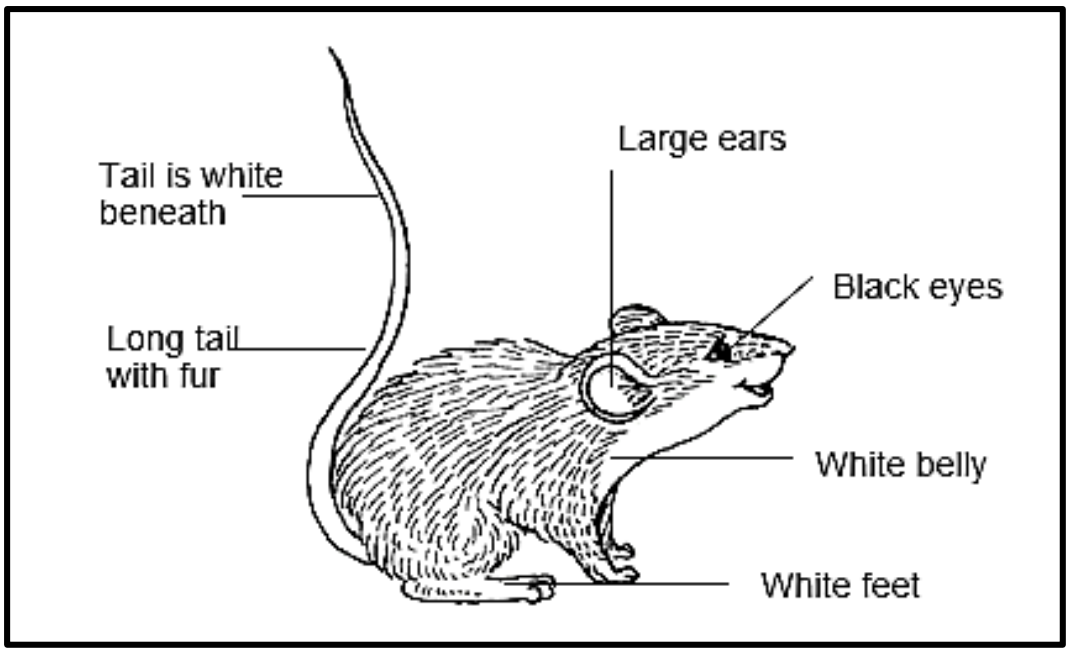
(a) Name this abnormality. (1)

(b) What genetic disorder would result in humans if this abnormality occurred in chromosome pair no. 21? (1)

(c) Give ONE symptom of the genetic abnormality mentioned in QUESTION 3.1.4 (b). (1)

3.2 Deer mice live in different habitats of North America. All have soft fur but the colour varies. Species living in dark, wet forests tend to have dark fur whereas those living in deserts with light sand dunes tend to have light coloured fur. Deer mice are preyed upon by owls.

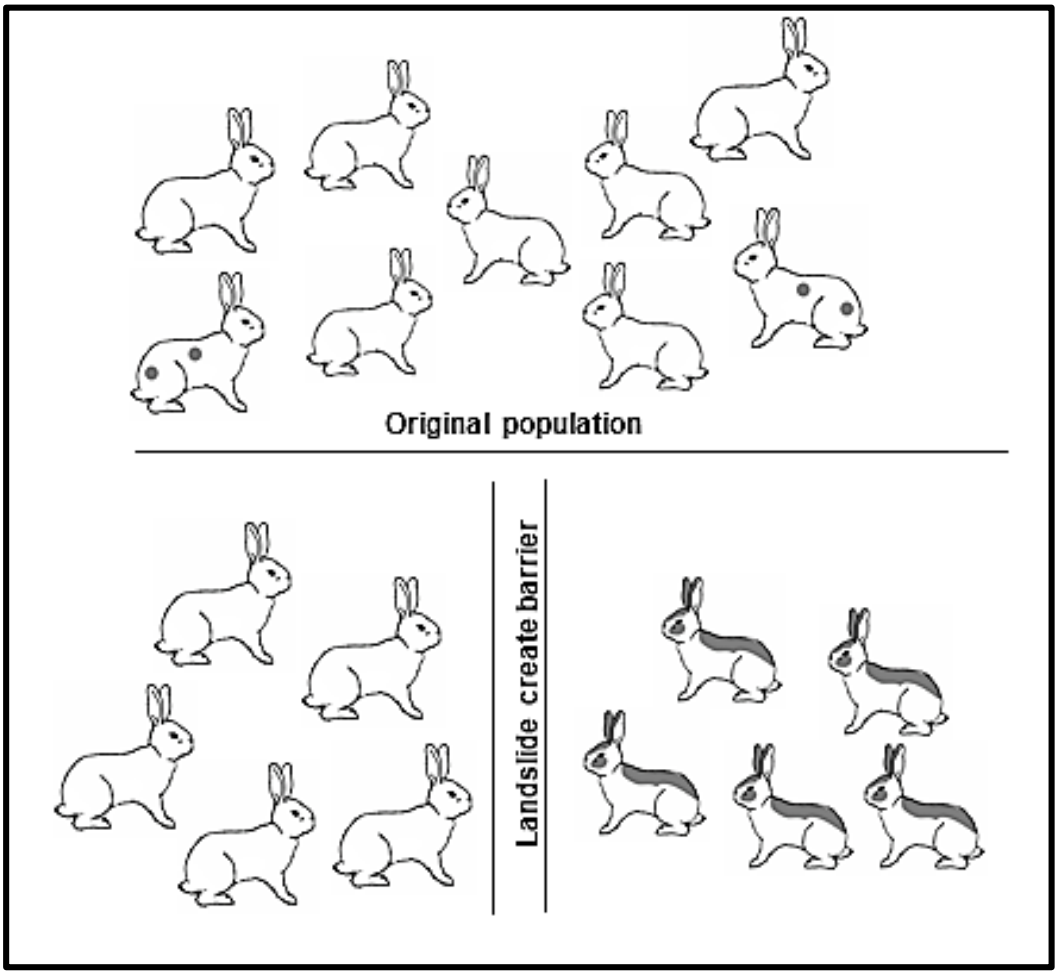
The picture below shows a deer mouse.



3.2.1 State ONE characteristic of the deer mouse which allows it to avoid predators. (1)

3.2.2 Use your understanding of natural selection to explain how the development of the allele for light coloured fur allowed the deer mice to survive in the sand dunes of Nebraska. (6)

3.3 The diagrams below show a process of evolution. The diagrams illustrate the events that occurred in the rabbit population over many years. Study them and answer the questions that follow.

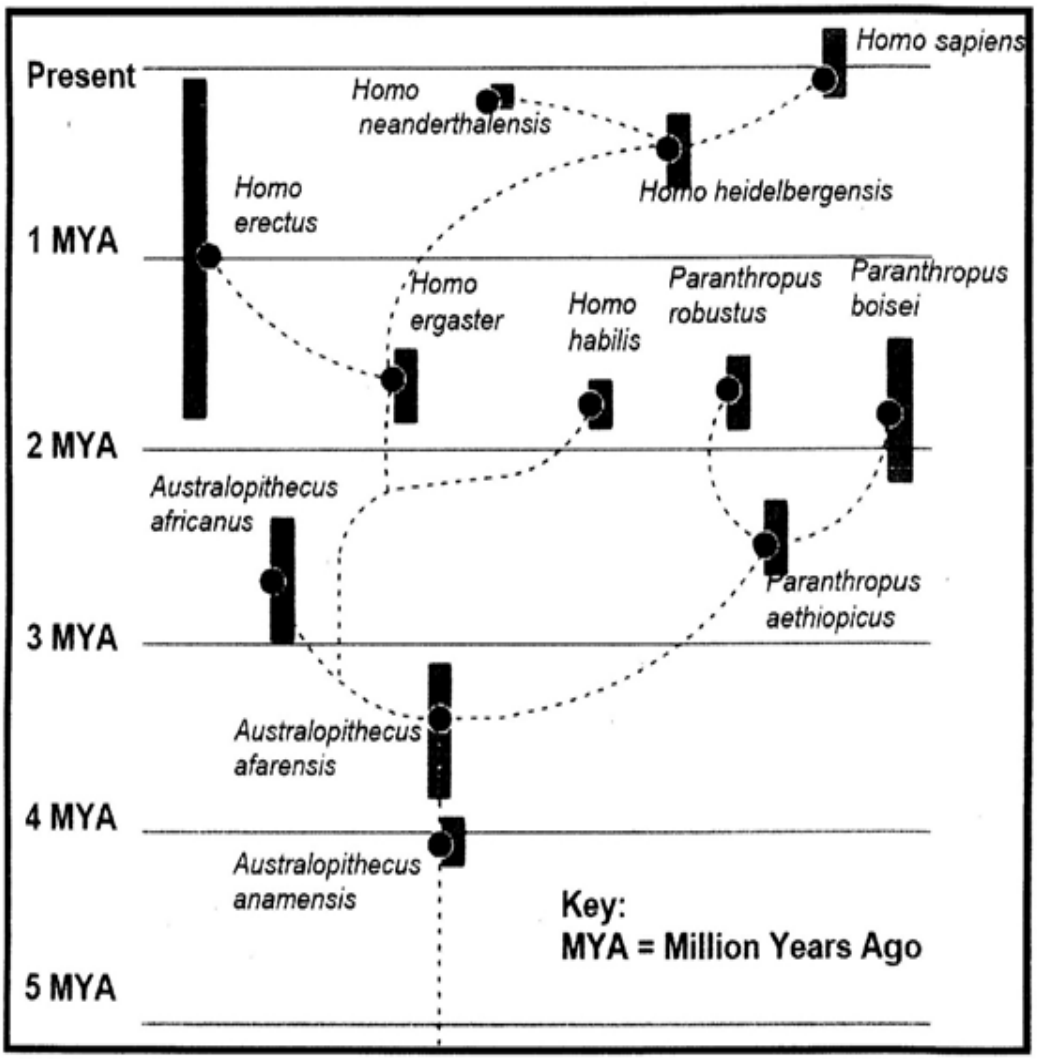


3.3.1 What evolutionary process is illustrated in the diagram above? (1)

3.3.2 Use the diagram to explain how the two new species evolved from the original population. (6)

3.3.3 State ONE observable difference between the two new species. (1)

3.4 Study the phylogenetic tree below showing the origins of humans. Possible evolutionary relationships are represented by the dotted lines and the vertical bars represent the time periods for which fossils are known for each species.



3.4.1 Identify the common ancestor of *Homo sapiens* and *Homo neanderthalensis*. (1)

3.4.2 When did *Australopithecus africanus* first appear on Earth? (2)

3.4.3 Explain the '*Out of Africa' hypothesis*. (2)

3.4.4 Identify the species from the above diagram which is said to be the first Hominid species to have moved out of Africa. (1)

3.4.5 Which species is the direct ancestor of *Homo habilis?* (1)

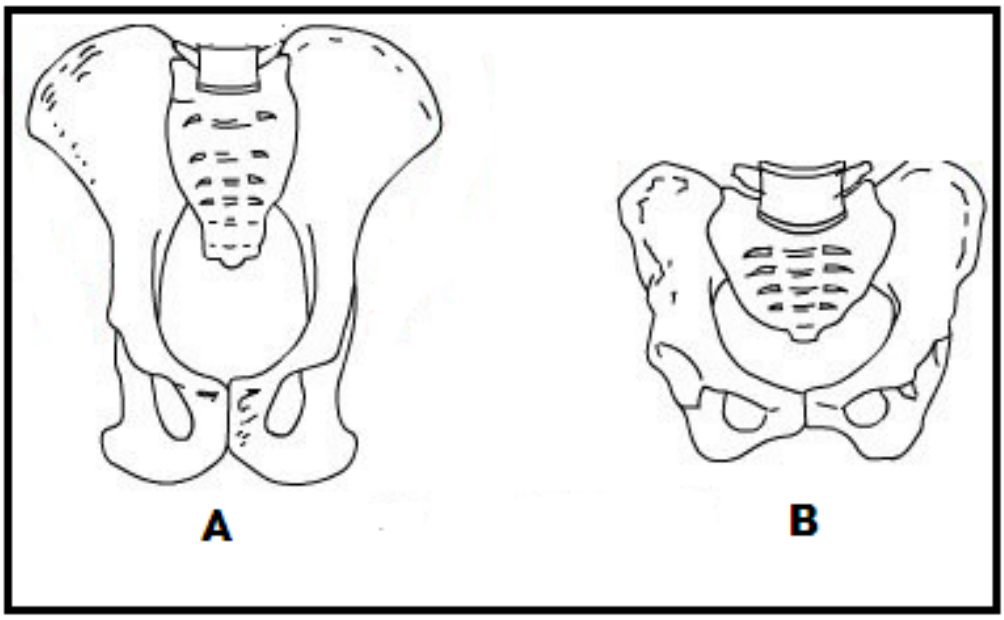
3.4.6 State the species to which the 'Taung child' belongs. (1)

3.4.7 A well-known example of *Australopithecus afarensis* is the fossil named Lucy.

(a) State the site where Lucy was discovered. (1)

(b) Name the scientist/s who discovered Lucy. (1)

3.5 Study the following diagrams showing the anterior (front) view of the pelvis/hips of a human and a chimpanzee.



3.5.1 Which of the above diagrams, **A** or **B** is the pelvis of a chimpanzee? (1)

3.5.2 Give a reason for your answer to QUESTION 3.5.1. (2)

3.5.3 Which pelvis **A** or **B,** indicates a fully bipedal organism? (1)

3.5.4 Explain your answer to QUESTION 3.5.3. (3)

[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Describe the evolutionary changes in the skull fossils of *Homo species* and the significance of each change as they evolved from the African apes.

(17)
Synthesis (3)

NOTE: NO marks will be awarded for answers in the form of flow charts, tables or diagrams.

TOTAL SECTION C: 20
GRAND TOTAL: 150