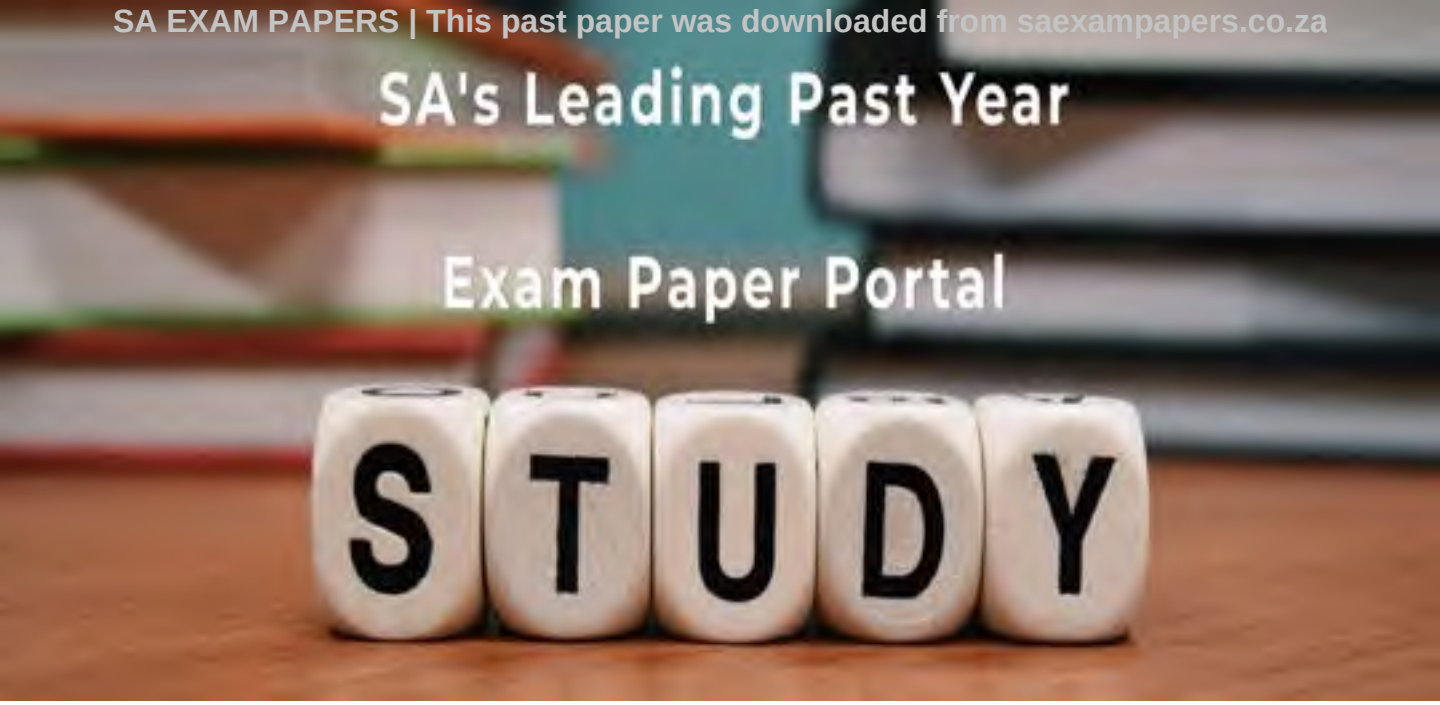


Western Cape Government
Education
FOR YOU

METRO NORTH EDUCATION DISTRICT

LIFE SCIENCES P2

GRADE 12

COMMON TRIAL EXAMINATION
SEPTEMBER 2024

MARKS: 150

TIME: 2 ½ hours

This exam paper consists of 16 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.

A Artificial selection is essential for the evolution of species
B Humans have now progressed from a technological age into an information age
C Modern species evolved from ancestral species
D Genetic mutations generally causes species to die

1.1.2 RNA differs from DNA in that it …

A has thymine and a phosphate group
B has deoxyribose and cytosine
C is a double stranded molecule
D has uracil and ribose

1.1.3 Blood group AB is a result of

A Complete dominance
B Incomplete dominance
C Co-dominance
D Polygenic inheritance

1.1.4 The chromosome complement of a human individual who inherits an X chromosome from the father, is

A 44 and XX
B 44 and XY
C 46 and XX
D 46 and XY

1.1.5 Evidence supporting the evolution theory is obtained by studying the structure of vertebrate forelimbs.

This type of evidence for evolution is best described as …

A biogeography.
B modification by descent.
C DNA evidence.
D genetic evidence.

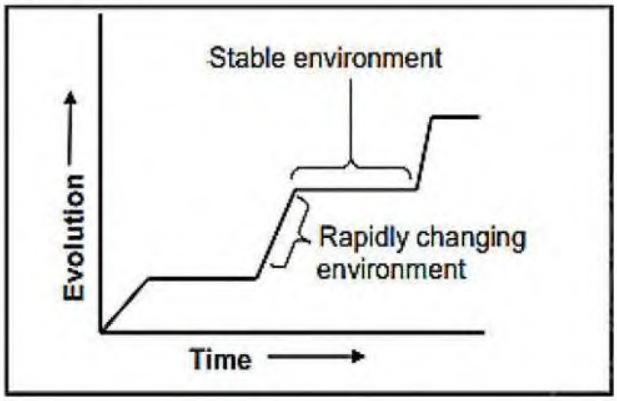
1.1.6 The probability that two heterozygous parents will have a homozygous dominant offspring, is …

A 75%
B 50%
C 25%
D 100%

1.1.7 Which ONE of the following is an example of artificial selection?

A DDT resistance in mosquitoes
B The development of different species of tortoise from a common ancestor
C The decreasing effect of antibiotics on bacteria
D Breeding dairy cattle to increase milk production

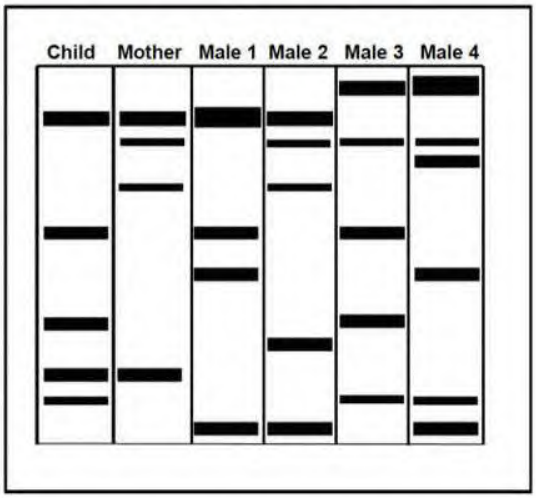
1.1.8 The graph below shows the pace at which evolution occurs in a species of butterfly.



Which type of evolution is represented by the graph?

A Speciation
B Punctuated equilibrium
C Artificial selection
D Inheritance of acquired characteristics

1.1.9 The diagram below shows the DNA profiles of a child, her mother and four males. There is uncertainty about who the biological father is. To establish paternity, DNA profiling was conducted.



Which male is the biological father of this child?

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

(9X2) **(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 group of similar organisms that can interbreed to produce fertile offspring

1.2.2 The biotechnological production of genetically identical offspring

1.2.3 The complete disappearance of a species from Earth

1.2.4 Alternative forms of a gene which occur at the same locus

1.2.5 A cell condition in which the nucleus contains a single set of chromosomes

1.2.6 An opening in vertebrate skulls through which the spinal cord passes

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

1.2.8 The family to which humans belong

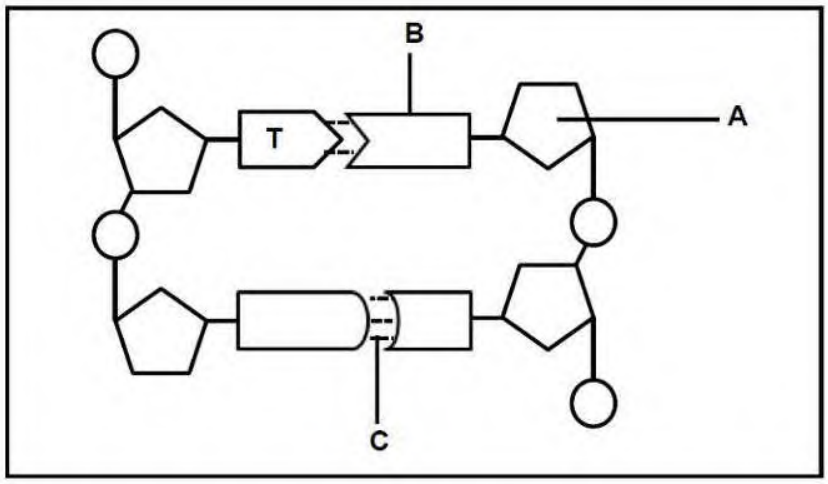
(8X1) **(8)**

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 scientist who proposed the law of segregation	A: Darwin B: Lamarck
1.3.2	The physical and functional expression of a gene	A: Genotype B: Phenotype
1.3.3	Examples of reproductive isolation mechanisms	A: Breeding at different times of the year B: Adaptation to the same pollinators

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

1.4 The diagram below shows a short section of a DNA molecule



1.4.1 What is the natural shape of a DNA molecule? (1)

1.4.2 Identify:

(a) Part **A** (1)

(b) The nitrogenous base **B** (full name is required) (1)

(c) Bond **C** (1)

1.4.3 Give ONE visible reason why the diagram above represents a DNA molecule. (1)

1.4.4 Name ONE place in the human body where this type of nucleic acid can be found. (1)

(6)

1.5 In tomatoes, red fruit **(R)** is dominant to yellow fruit **(r)**. Round fruit **(B)** is dominant to pear-shaped fruit **(b)**.

Two plants that are heterozygous for both characteristics were crossed.

1.5.1 State the:

(a) Phenotypes of the P_1 -parents (2)

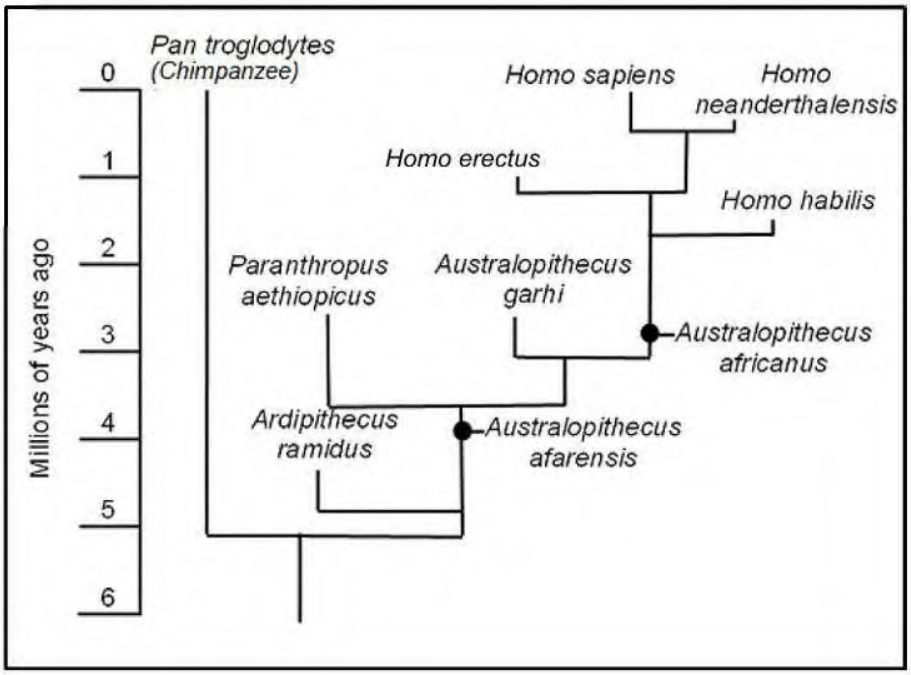
(b) Genotypes of the P_1 - parents (2)

1.5.2 Give ALL the possible genotypes of the **gametes** that will be formed. (2)

1.5.3 How many plants in the next generation are likely to have yellow and pear-shaped fruit? (1)

(7)

1.6 The diagram below shows possible evolutionary relationships amongst some hominids.



1.6.1 Identify the type of diagram above? (1)

1.6.2 How many genera are represented in this diagram? (1)

1.6.3 When, according to the diagram, did *Homo erectus* become extinct? (1)

1.6.4 Name the most recent common ancestor of all the *Homo* - species. (1)

1.6.5 According to the diagram above, name ONE species that may have been outcompeted by *Homo sapiens*. (1)

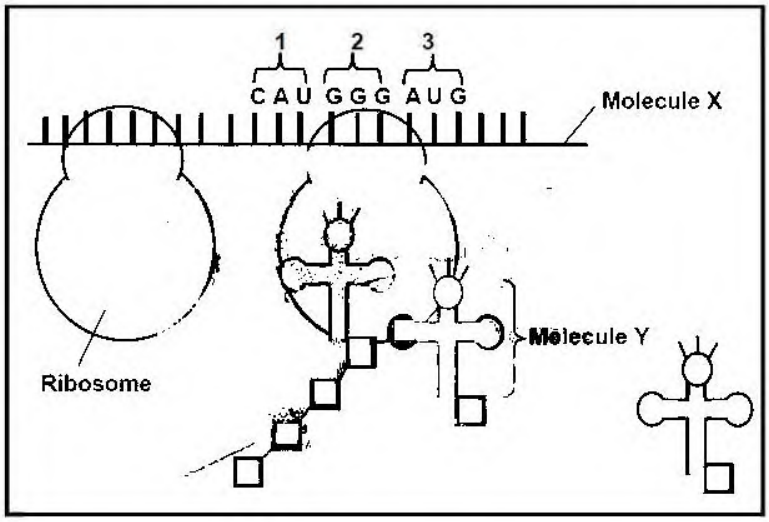
(5)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below shows a part of the process of protein synthesis.



2.1.1 Identify:

(a) Molecule **X** (1)

(b) Structure **1** (1)

2.1.2 Describe the role of molecule **Y** during this stage of protein synthesis. (3)

2.1.3 The table below shows the DNA base triplets that code for different amino acids found in human proteins.

AMINO ACID	BASE TRIPLET IN DNA
Leucine	GAA
Proline	GGG
Lycine	TTT
Histidine	GTA
Serine	TCA
Methionine	TAC
Glycine	CCC
Glutamine	GTC

Use the information in the table and the diagram above, write down the sequence of amino acids that correspond with structures **2** and **3**. (2)

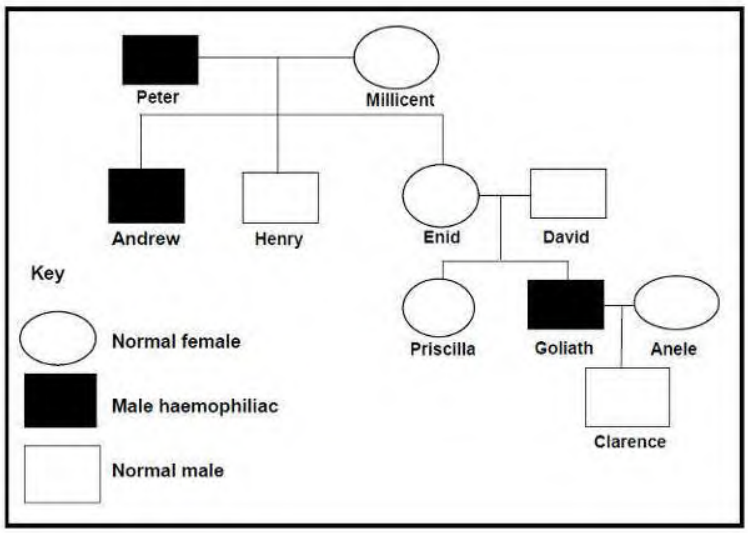
2.1.4 During the process of protein synthesis, there was a change in the amino acid sequence from histidine to glutamine.

Explain the possible reason for this. (3)

(10)

2.2. Describe the process by which DNA makes a copy of itself. **(6)**

2.3 Study the pedigree diagram of a family where some individuals have haemophilia. Haemophilia is a sex-linked disorder. Use **H** for normal blood clotting and **h** for the haemophilic trait.



2.3.1 Identify:

(a) the number of generations in this diagram (1)

(b) the number of males with haemophilia (1)

2.3.2 Write down all the possible genotypes of the following individuals:

(a) Peter (2)

(b) Enid (2)

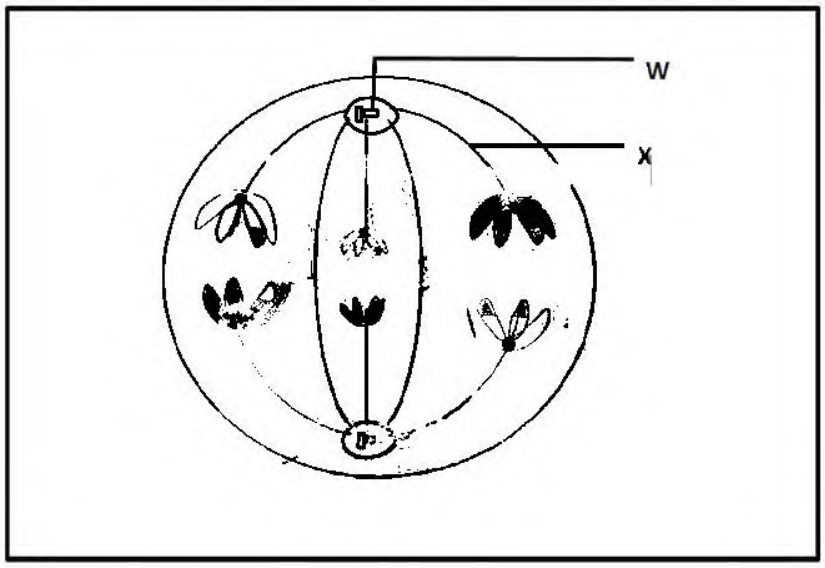
(c) Clarence (2)
(8)

2.4 Pie-baldism is a genetic condition which is characterised by a person having a white patch of hair. Pie-baldism is controlled by a dominant allele **(H).**

A man with a white patch of hair and a woman with a white patch of hair have two children. The first child was born without a patch of hair, the second child was born with a patch of hair.

2.4.1 Use a genetic cross to show the possibility of producing the phenotypes of the children as described above. **(6)**

2.5 The diagram below represents a phase during meiosis.



2.5.1 Identify structures labelled: (1)

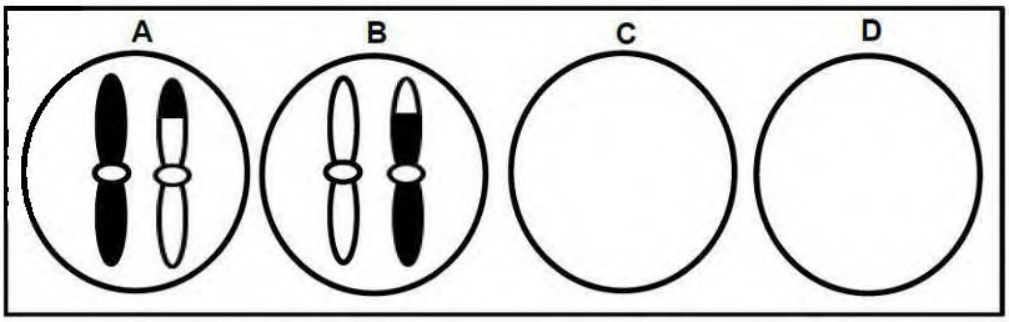
(a) **W** (1)
(b) **X**

2.5.2 Identify the phase shown above. (1)

2.5.3 State why this cell does not represent a human cell. (1)

2.5.4 Explain the contribution of the previous phase to natural selection. (6)
(10)

2.6 The diagrams below represent the distribution of chromosome pair 21 as it appears in gametes at the end of meiosis II in a human male.



2.6.1 Explain why the gametes represented by diagrams **C** and **D** do not have any chromosomes. (3)

2.6.2 If gamete **A** is involved in fertilisation, describe how this may result in Down syndrome. (3)

2.6.3 Due to the process of crossing over, the chromosomes in diagrams **A** and **B** appear different to each other.

(a) Identify the phase of meiosis during which crossing over occurs. (1)

(b) Describe the events during crossing over. (3)

(10)

[50]

QUESTION 3

3.1 Weeds are problematic to farmers because they invade farm fields and outcompete crop plants for space. This reduces the crop yield.

Farmers spray their fields with chemicals, known as herbicides, to kill the weeds. Some weeds, however, have evolved to be resistant to herbicides.

Scientists investigated the time it took for a species of weed to develop resistance to five types of herbicides. The results are shown in the table below.

TYPES OF HERBICIDE	TIME TAKEN FOR WEEDS TO DEVELOP RESISTANCE (YEARS)
2,4-D	9
Dalapon	9
Picloran	25
Dicloflop	7
Trifluralin	26

3.1.1 Identify the:

(a) Independent variable (1)

(b) Dependent variable (1)

3.1.2 Name the herbicide:

(a) To which the weeds developed resistance the fastest (1)

(b) That remained effective for the longest period of time (1)

3.1.3 The scientists used the same weed species when investigating resistance to the different herbicides.

(a) Describe how the scientists would have determined the resistance of the weeds to the herbicides (2)

(b) Explain how the use of the same weed species improved the validity of the investigation. (2)

3.1.4 Draw a bar graph to show the time taken for the evolution of resistance to the herbicides. (6)
(14)

3.2 Stem cells were cultured under ideal laboratory conditions to replace damaged cells associated with several disorders in the human body.

The table below represents the number of stem cells used in the treatment of some of the disorders.

DISORDERS	NUMBER OF STEM CELLS IN MILLIONS
Cancer	450
Alzheimer's disease	200
Heart disease	150
Diabetes	90

3.2.1 State TWO sources of stem cells. (2)

3.2.2 Name ONE other use of stem cells, other than the treating of disorders. (1)

3.2.3 Write down the ratio (in the simplest form) of stem cells used to treat cancer compared to heart disease. Show ALL your working. (2)
(5)

3.3 A group of learners investigated the frequency of dominant and recessive traits in their school. Their hypothesis was:

There will be more learners with dominant traits than learners with recessive traits.

The traits below were investigated in 200 learners:

DOMINANT TRAIT	RECESSIVE TRAIT
Unattached earlobe	Attached earlobe
Rolled tongue	Unrolled tongue
Bent little finger	Straight little finger

The results below were obtained during the investigation.

	NUMBER OF LEARNERS	
TRAIT	DOMINANT	RECESSIVE
Earlobe	60	140
Tongue	28	172
Little finger	15	185

3.3.1 State any TWO planning steps that the learners had to consider before conducting the investigation. (2)

3.3.2 Explain why age need NOT be controlled in this investigation. (2)

3.3.3 State ONE way in which the learners ensured reliable results. (1)

3.3.4 Will the learners accept or reject their hypothesis? (1)

3.3.5 Explain your answer to QUESTION 3.3.4. (2)

3.3.6 Name the type of variation investigated with the traits. (1)

3.3.7 Give a reason for your answer in QUESTION 3.3.6. (2)
(11)

3.4 Describe the process of *speciation* through geographic isolation. **(7)**

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

3.5.1 Name ONE characteristic regarding the hand, that African apes share with humans. (1)

3.5.2 Tabulate TWO differences between the skulls of African apes and humans. (5)

3.5.3 Give TWO characteristics of the pelvis of a bipedal organism. (2)
(8)

3.6 The 'Out of Africa' hypothesis is one explanation of the evolution of modern humans.

3.6.1 Name the type of genetic evidence used to support the 'Out of Africa' hypothesis? (1)

3.6.2 Describe how fossil evidence of the *Homo* genus is used to support the 'Out of Africa' hypothesis. (4)
(5)
[50]

TOTAL SECTION B: 100
GRAND TOTAL: 150