GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

2015

10832

LIFE SCIENCES

SECOND PAPER

MARKS: 150
TIME: 2½ hours

Pages 19

X10

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(Second Paper)

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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. Make ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, flow charts or tables 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 given 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 The only difference between the DNA of one member of a species and that of another member of the same species is the …

A order in which the bases occur in their chromosomes.
B type of bonds present between the bases.
C number of strands that make up the DNA.
D positioning of the phosphate and sugar portion in the DNA.

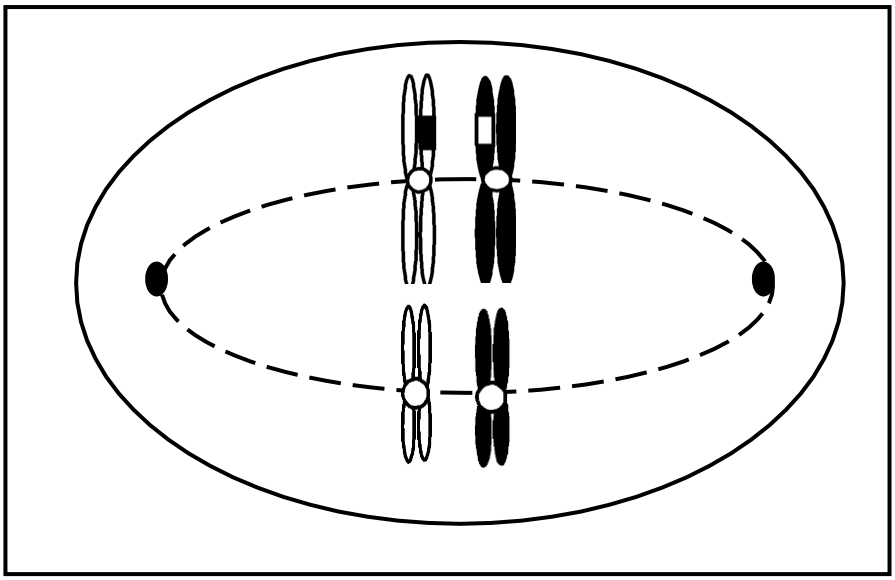
1.1.2 If 20% of the bases in a molecule of DNA are cytosine, what is the ratio of guanine to thymine in the same molecule?

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

1.1.3 The offspring, of a pure breeding brown horse that had been crossed with a pure breeding white mare (female horse), were interbred. Brown is dominant. The expected percentage offspring will be ...

A 50% brown and 50% white.
B 100% brown.
C 25% brown and 75% white.
D 75% brown and 25% white.

1.1.4 The diagram below represents a phase in meiosis.



The following are events that take place in meiosis.

(i) Chromosomes are in metaphase I.
(ii) Crossing over has taken place.
(iii) Chromosomes are in the metaphase II stage.
(iv) Chromosomes are arranged in homologous pairs.

Which of the statements is TRUE regarding the diagram above?

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

1.1.5 The natural shape of a DNA molecule is …

A a single coiled strand.
B a double helix.
C the same as that of tRNA.
D the same as that of mRNA.

1.1.6 In DNA, if the sequence of bases is AGG TTA CCG on the one strand, the corresponding bases on the other strand are …

A	ACC	GGA	TTC.
B	TAA	CCG	CCT.
C	TCC	AAT	GGC.
D	CTT	GGT	CCT.

1.1.7 A tentative explanation for an observation is known as a…

A hypothesis.
B theory.
C law.
D fact.

1.1.8 Darwin made most of his observations about evolution on the …

A Islands of Hawaii.
B Indonesian Islands.
C Galapagos Islands.
D Phi Phi Islands.

1.1.9 Homologous chromosomes are described as ...

A being similar in structure and coding for the same characteristics.
B a product of the division of chromosomes.
C identical daughter chromatids formed through DNA replication.
D two chromosomes that code for different characteristics.

1.1.10 Four different phenotypes are possible in the F_1-generation if the parents' blood groups are ...

A B and B.
B A and B.
C O and AB.
D AB and AB. (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 1.2.8) in the ANSWER BOOK.

1.2.1 The representation of the DNA of a person as a series of light and dark bands

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

1.2.3 The change of the genetic material of an organism by humans to get desired changes

1.2.4 The explanation that species experience long periods without physical change, followed by short periods of rapid physical change

1.2.5 The phase of meiosis during which homologous chromosomes separate and start moving towards opposite poles

1.2.6 The defect in cell division that leads to Down's syndrome

1.2.7 The structure that is made up of two chromatids joined by a centromere

1.2.8 A group of organisms that have similar characteristics that can interbreed to produce fertile offspring

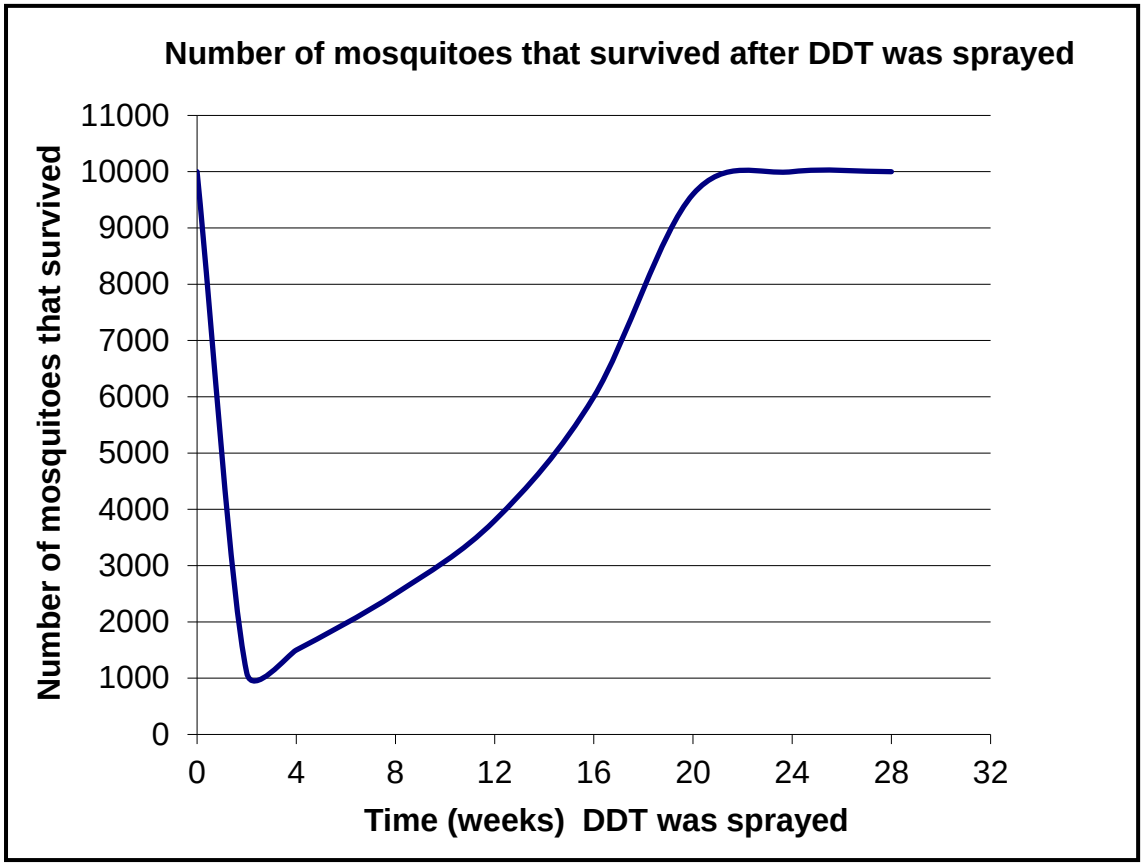
(8)

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 (1.3.1 to 1.3.6) in the ANSWER BOOK.

COLUMN I		COLUMN II
1.3.1	Discovered the shape of the DNA molecule	A: Francis Crick B: James Watson
1.3.2	Evidence for evolution	A: Biogeography B: Genetics
1.3.3	Darwin's observations	A: Variations in a population B: Production of more offspring than is required
1.3.4	An example of a reproductive isolating mechanism	A: Species-specific courtship behaviour B: Infertile offspring
1.3.5	Fossil site/s in Africa	A: Sterkfontein B: Great Rift Valley
1.3.6	A type of cell division that occurs for the production of gametes	A: Meiosis B: Mitosis

(6 x 2) **(12)**

1.4 An investigation was conducted over a period of 32 weeks to test a hypothesis that mosquitoes develop resistance to DDT. The results of the investigation are given below. Study the graph below and answer the questions.



1.4.1 At which period of time did the mosquitoes begin to develop resistance towards DDT after spraying took place? (2)

1.4.2 What was the approximate number of mosquitoes that were non-resistant to DDT at the initial time of spraying? (Show all working) (2)

1.4.3 How long did it take for the mosquito population to reach its maximum number? (1)
[5]

1.5 Read the passage below about the 'Out of Africa" hypothesis.

Origin of modern humans

The 'Out-of-Africa' hypothesis proposes that modern humans originated only in Africa; then they migrated and supplanted populations of *Homo* in Asia and Europe about 1 000 000 years ago.

[Adapted from: Biology, 6th edition, p.359]

1.5.1 Which continent is believed to be the 'motherland' of the *Homo* species? (1)

1.5.2 Name TWO types of evidence that can be used to support the 'Out of Africa' hypothesis. (2)

1.5.3 Name the oldest hominid that was found in Africa? (2)

[5]

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The following diagram shows an important process that occurs during cell division.

PROCESS IN CELL CYCLE

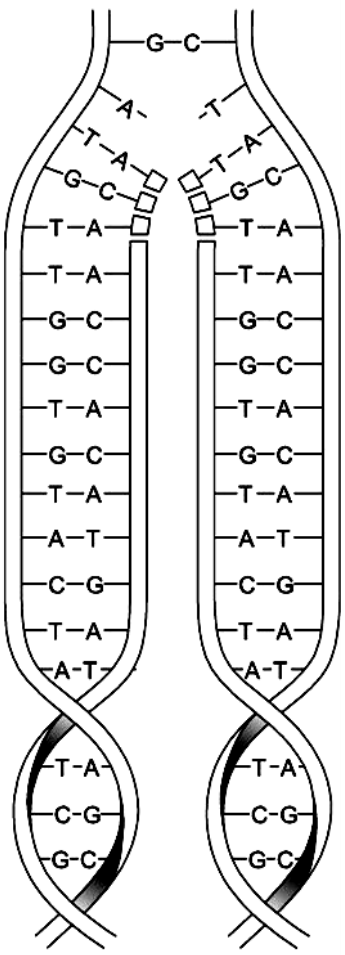


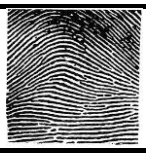
Diagram A

2.1.1 Name the process that is being represented in the diagram above. (1)

2.1.2 During which phase in the cell cycle does the process mentioned in QUESTION 2.1.1 occur? (1)

2.1.3 Describe the process that is illustrated in diagram **A**. (3)
(5)

2.2 Humans show variations in characteristics such as fingerprints. Humans have five main types of fingerprints as shown in the diagram below.

				
Tented arch	Plain arch	Loop	Double loop	Plain whorl

Learners carried out an investigation based on the following hypothesis that they formulated:

"Most learners have the plain arch-type of fingerprint."

2.2.1 State TWO planning steps that must be considered by the learners before the investigation. (2)

2.2.2 Explain ONE precaution that the learners must take to ensure the results are valid. (2)

2.2.3 List TWO ways in which the reliability of the investigation could be improved. (2)

2.2.4 The results of the investigation are shown in the table below.

Main types of fingerprints	Number of learners
Double loop	60
Loop	126
Tented arch	115
Plain arch	120
Plain whorl	159

(a) Identify the independent variable in this investigation. (1)

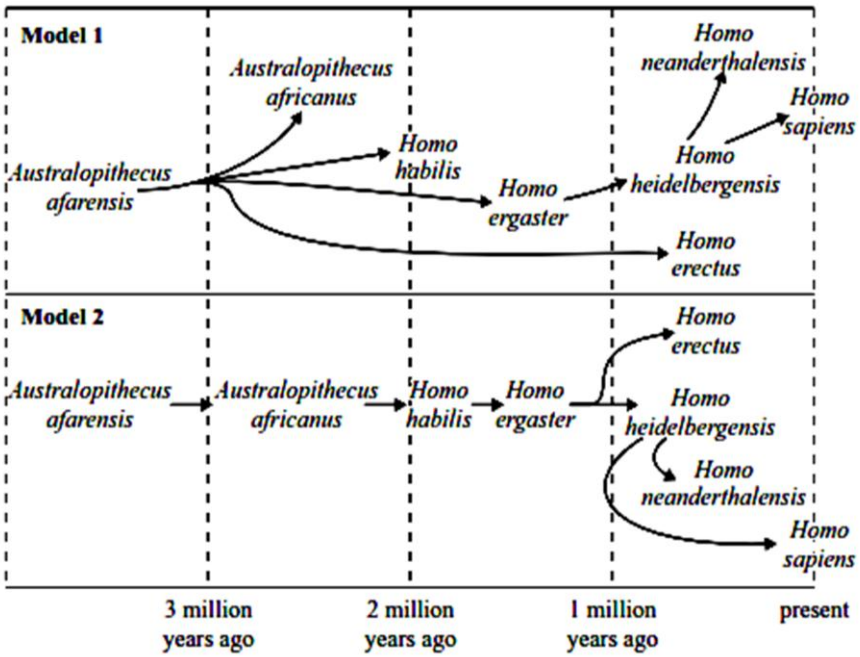
(b) Identify the dependent variable in this investigation. (1)

(c) Explain whether the learners' hypothesis will be accepted or rejected in terms of the results recorded in the table. (2)

(10)

2.3 Two paleoanthropologists used the same fossil data to draw a model of a hominid evolutionary tree. The two models they produced are shown below. Study the models and answer the questions that follow.

PHYLOGENETIC TREES SHOWING HUMAN EVOLUTION



Adapted from *Advanced Biology*, M Kent, 2000

2.3.1 Name the common ancestor to all hominids in both models. (1)

2.3.2 How many million years ago did *Homo erectus* first appear on earth in both models? (1)

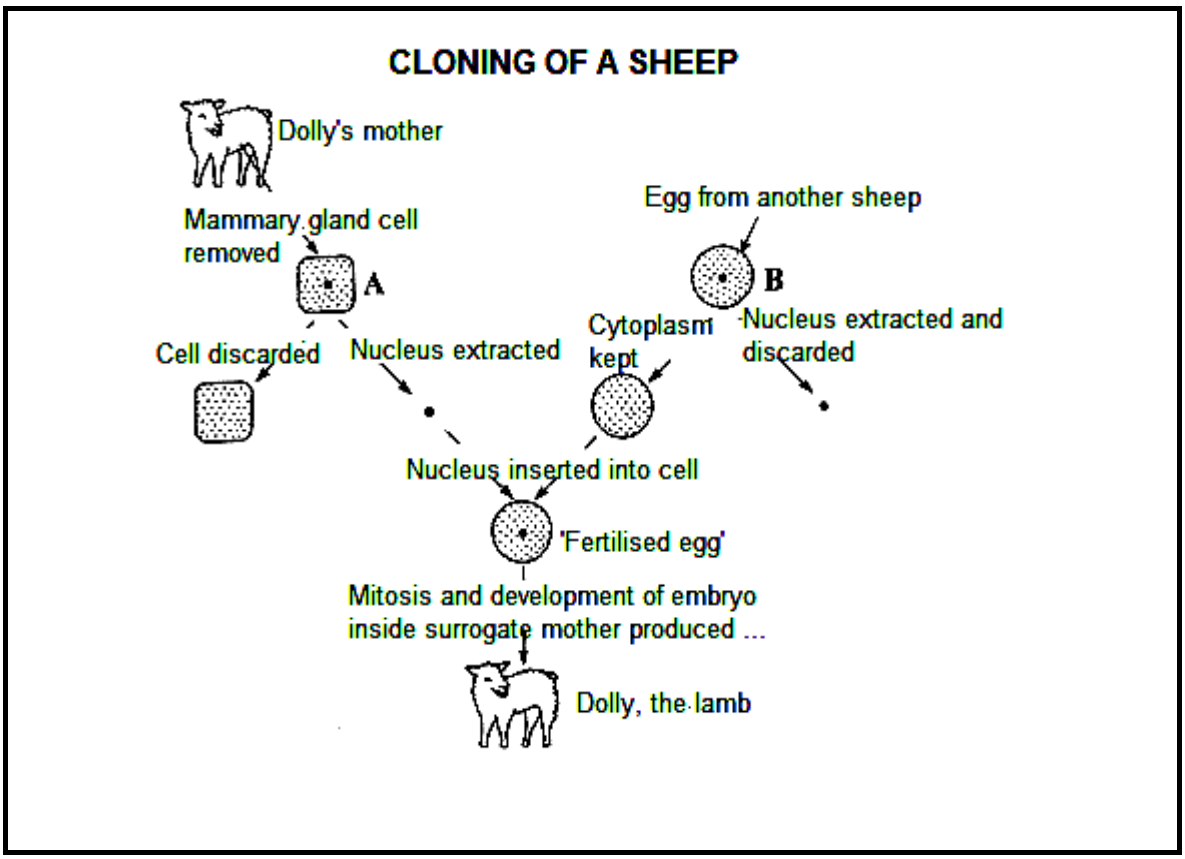
2.3.3 Tabulate TWO differences regarding the evolution of *Homo erectus* and *Homo habilis* in both models. (5)

2.3.4 State ONE reason why *Homo ergaster* in Model 1 will be regarded as a 'transitional fossil'. (1)

2.3.5 Name TWO fossils found in South Africa that had characteristics of the *Australopithecus africanus.* (2)
(10)

2.4 In 1997, scientists from the Roslin Institute in Scotland claimed that they had cloned a lamb from a cell taken from the mammary gland of a sheep. The lamb was called 'Dolly' and she became famous as she was the first mammal formed from a non-reproductive cell.

The diagram illustration below summarises the process the scientists used.



2.4.1 Is Cell **A** formed by mitosis or meiosis? Give a reason for your answer. (2)

2.4.2 Give ONE reason why the nucleus from the egg cell of 'another sheep' was discarded. (1)

2.4.3 Explain why the words 'fertilised egg' has inverted commas. (1)

2.4.4 Give ONE reason why some people may object to cloning. (1)
(5)

2.5 In a certain type of parrots it was found that red eye colour (R) is dominant over black eye colour (r), while grey tail feathers (G) were dominant over white tail feathers (g).
A parrot breeder crosses a female homozygous for red eyes and grey tail feathers with a male homozygous for black eyes and white tail feathers.

2.5.1 Name the genotype of the:

(a) Female parrot (1)

(b) Male parrot (1)

2.5.2 Write down the genotypes of the gametes of the female. (2)

2.5.3 Give the phenotype of an offspring having the genotype:

(a) rrGg (1)

(b) RrGg (1)
(6)

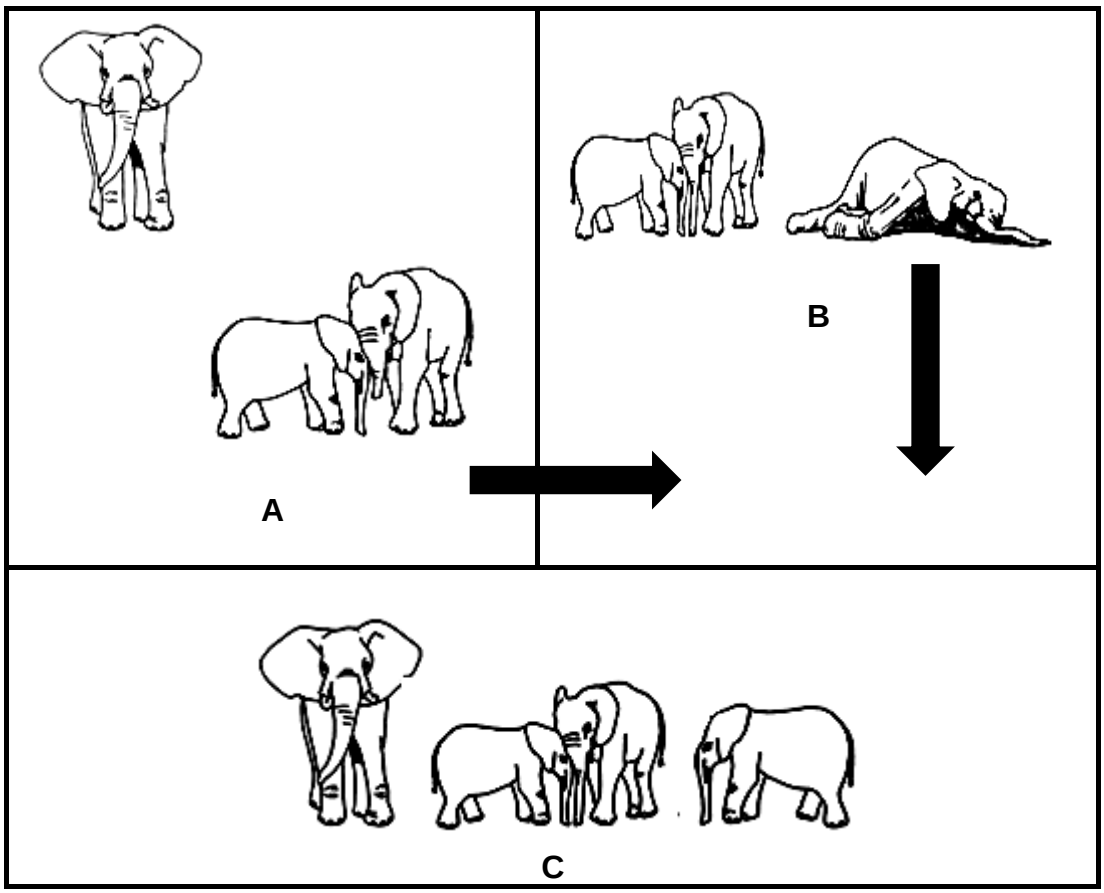
2.6 Distinguish between:

2.6.1 Continuous and (2)

2.6.2 Discontinuous variation (2)
(4)
[40]

QUESTION 3

3.1 The following diagram illustrates the evolutionary process of selection for long trunks in elephants. The most notable feature of all elephants is a long trunk or proboscis, used for many purposes, particularly breathing, lifting water and grasping objects.



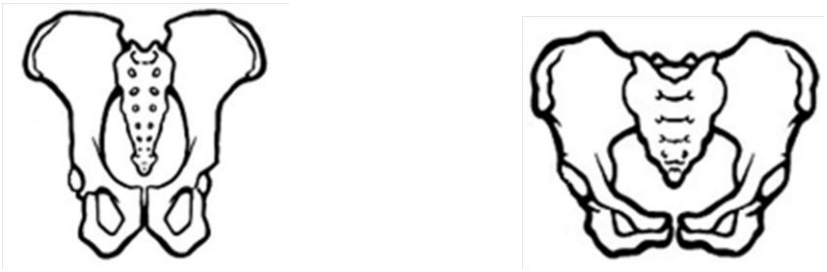
3.1.1 Use the diagrams above to explain how Darwin would account for the long trunks of elephants. (6)

3.1.2 State the TWO Laws of Lamarck. (2)
(8)

3.2 Humans are classified as primates, a group which includes chimpanzees. Although there are differences between humans and other living primates, we also share many characteristics with them, suggesting a common ancestor.

Study the diagrams below showing the pelvis of *Pan troglodyte (chimpanzee) and Homo sapiens* and answer the questions that follow.

Pan troglodyte ***Homo sapiens***



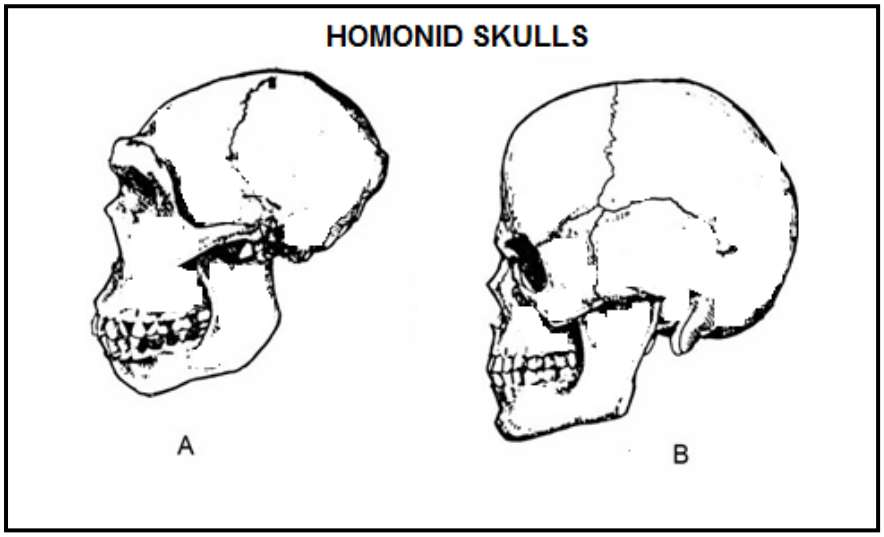
Pelvis of *Pan troglodyte* and *Homo sapiens*

3.2.1 State what is meant by the term **bipedalism.** (2)

3.2.2 Explain TWO advantages of bipedalism. (4)

3.2.3 Provide TWO reasons why the pelvis of *Homo sapiens* is better adapted for bipedalism compared to chimpanzees. (4)
(10)

3.3 The diagram below shows the skulls of two different hominids. Use the diagrams and answer the questions that follow.

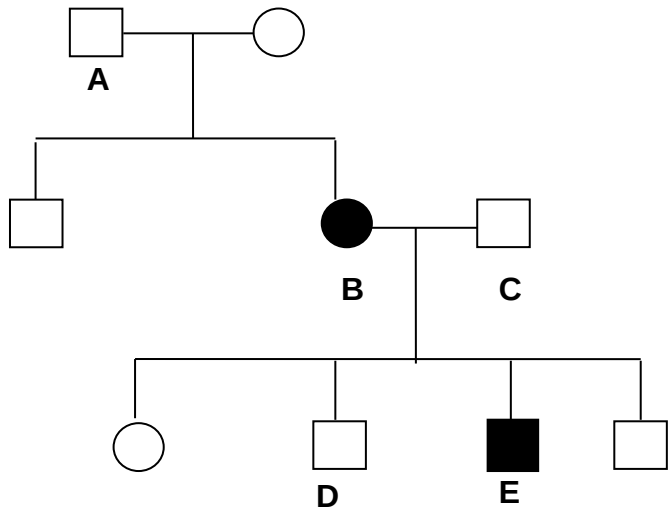


3.3.1 Which of the diagrams represents an *Australopithecus sp.?* (1)

3.3.2 Tabulate TWO visible differences between the cranium and brow ridges between A and B that indicate an evolutionary trend in homonids. (5)

3.3.3 Describe ONE way in which the skull of **A** is adapted to a diet of raw, tough food. (2)
(7)

3.4 The pedigree diagram below shows the inheritance of colour blindness in a family. The normal allele is represented by X^D and the allele causing colour blindness is represented by X^d.



Key:

Normal male

Normal female

Colour blind male

Colour blind female

Pedigree diagram to show inheritance of colour blindness

3.4.1 Determine the:

(a) Phenotype of individual **D** (1)

(b) Genotype of individual **A** (2)

3.4.2 State ONE reason why colour blindness is regarded as a sex-linked disorder. (1)

3.4.3 Explain why females have a smaller chance of suffering from colour blindness than men. (3)

3.4.4 Represent a genetic cross to show the percentage chance of individuals **B** and **C** having another colour blind son. (7)

(14)

[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Describe the process by which proteins are produced in the cells of the human body and explain how gene mutations lead to altered characteristics resulting in haemophilia, albinism and colourblindness.

Content: **(17)**
Synthesis: **(3)**

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

TOTAL SECTION C: 20
GRAND TOTAL: 150

END