Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2015

LIFE SCIENCES P2

MARKS: **150**

TIME: **2½ hours**

LFSCE2

This question paper consists of 15 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 ANSWERBOOK.
3. Start EACH question on a NEW PAGE.
4. Number the answers correctly according to the numbering system used in this question paper.
5. If answers are NOT presented according to the instructions of each question, candidates will lose marks.
6. All drawings should be done in pencil and labelled in blue or black ink.
7. Draw diagrams, flow charts and tables ONLY when requested to do so.
8. The diagrams in this question paper may NOT necessarily be drawn to scale.
9. The use of graph paper is NOT permitted.
10. A non-programmable calculator, protractor and compass may be used.
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), for example 1.1.11 D.

1.1.1 What is the genotype of pure breeding plants?

A Homozygous
B Heterozygous
C Dihybrid
D Monohybrid

1.1.2 Which of the following is the scientific name for modern humans?

A *Homo erectus*
B *Homo africanus*
C *Homo sapiens*
D *Homo habilis*

1.1.3 Which of the following shows the process of DNA replication in the correct sequence?

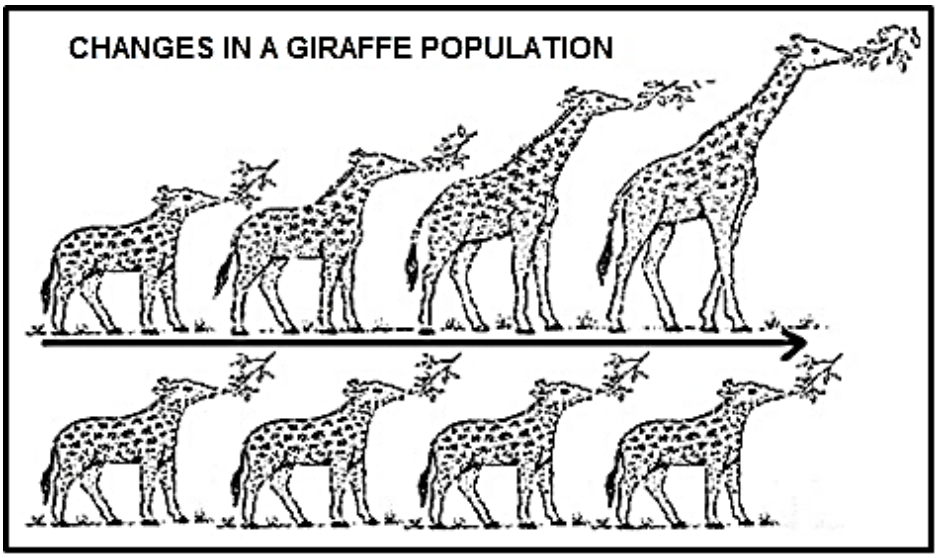
A DNA double helix ⟶ strand separate⟶ matching bases pair up ⟶ two DNA double helixes
B Two DNA double helixes ⟶ strands separate ⟶matching bases pair up ⟶ DNA double helix
C Strands separate ⟶ two double helixes ⟶ matching bases pair up ⟶ DNA double helix
D DNA double helix ⟶ strands separate ⟶ two DNA double helixes ⟶ matching bases pair up

1.1.4 The presence of freckles is a dominant characteristic. A child's mother has no freckles and father is heterozygous for freckles.

What is the probability that this child will have freckles?

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

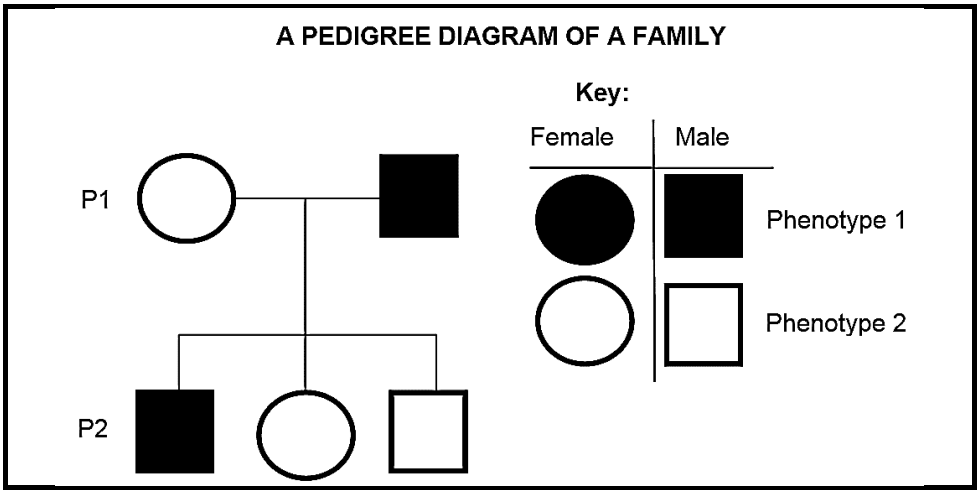
1.1.5 Which law/s is illustrated by the diagram below?



(i) Law of use and disuse
(ii) Law of inheritance of acquired characteristics
(iii) Law of dominance

A i, ii and iii
B i and ii only
C i only
D i and iii only

1.1.6 The pedigree shows the inheritance of a sex linked disease controlled by a gene with two alleles A and B. Study the diagram and answer the question that follows.



Which Punnett square correctly represents the cross between the P1-parents?

A

	A	B
A	AA	AB
B	AB	BB

B

	B	b
A	AB	Ab
a	aB	ab

C

	B	B
A	AB	AB
A	AB	AB

D

	B	B
B	BB	Bb
b	Bb	Bb

1.1.7 Identical twins have the same genotype. Why are there small differences between the phenotypes of identical twins?

A Environment affects the expression of genes.
B Some genes are not dominant.
C Both parents are homozygous for those phenotypes.
D Both parents are heterozygous for those phenotypes.

1.1.8 Which of the following correctly identifies the relationship between alleles, chromosomes, and genes?

A Genes contain chromosomes and alleles.
B Chromosomes contain genes but not alleles.
C Alleles are found in chromosomes but not in genes.
D Genes are part of chromosomes and have different alleles.

1.1.9 Changes that are important in human evolution towards bipedalism:

1. Enlargement of the brain
2. Tool making
3. S-shaped spine
4. *Foramen magnum* moves to a forward position

A 1, 2, 3 and 4
B 1, 2 and 3 only
C 1, 2 and 4 only
D 1, 3 and 4 only

1.1.10 The scientist who found the Taung skull (*Australopithecus africanus*) in 1924:

A Robert Broom
B Raymond Dart
C Phillip Tobias
D Mary Leakey (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 (1.2.1–1.2.8) in the ANSWER BOOK.

1.2.1 The structure that is formed when many amino acids combine

1.2.2 The structure on which the anticodon for protein synthesis is located

1.2.3 The bonds that form between nitrogenous bases in a DNA

1.2.4 A process by which new species are formed in a short period of time, where rapid changes occur through natural selection

1.2.5 The organelle in a cell on which protein synthesis occurs

1.2.6 The nitrogenous base that occurs only in RNA

1.2.7 The synthesis of mRNA from DNA

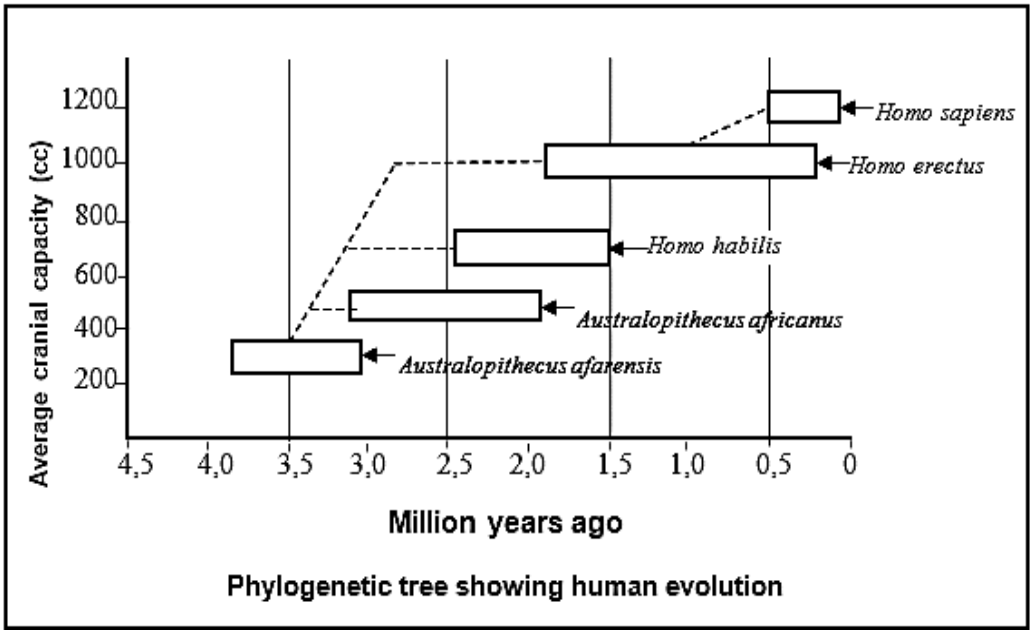
1.2.8 The type of sugar that is found in RNA (8 x 1) (8)

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 in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	An explanation for something that has been observed in nature, which is supported by facts, models and laws	A: Theory B: Hypotheses
1.3.2	The number of chromosomes in a normal human body	A: 23 Chromosomes B: 46 Chromosome
1.3.3	Their work made us aware of how genes are inherited	A: Darwin B: Mendel
1.3.4	The DNA in the nucleus of a non-dividing cell	A: Chromatin B Chromosome
1.3.5	The evidence used to support the 'Out of Africa' hypothesis by tracing the maternal lineage	A: Mitochondrial DNA B: Y-chromosome
1.3.6	Influences the inheritance of blood groups	A: Co-dominance B: Multiple alleles

(6 x 2) (12)

1.4 Study the phylogenetic tree below and answer the questions that follow.



Phylogenetic tree showing human evolution

1.4.1 Define a *phylogenetic tree*. (2)

1.4.2 Which organism is considered to be the common ancestor? (1)

1.4.3 Which organism has the biggest cranial capacity? (1)

1.4.4 Name TWO species that lived between 1,5 and 2 million years ago. (2)

1.4.5 Calculate the time difference between the evolution of *Homo erectus* and *Homo sapiens*. (Show your working.) (3)

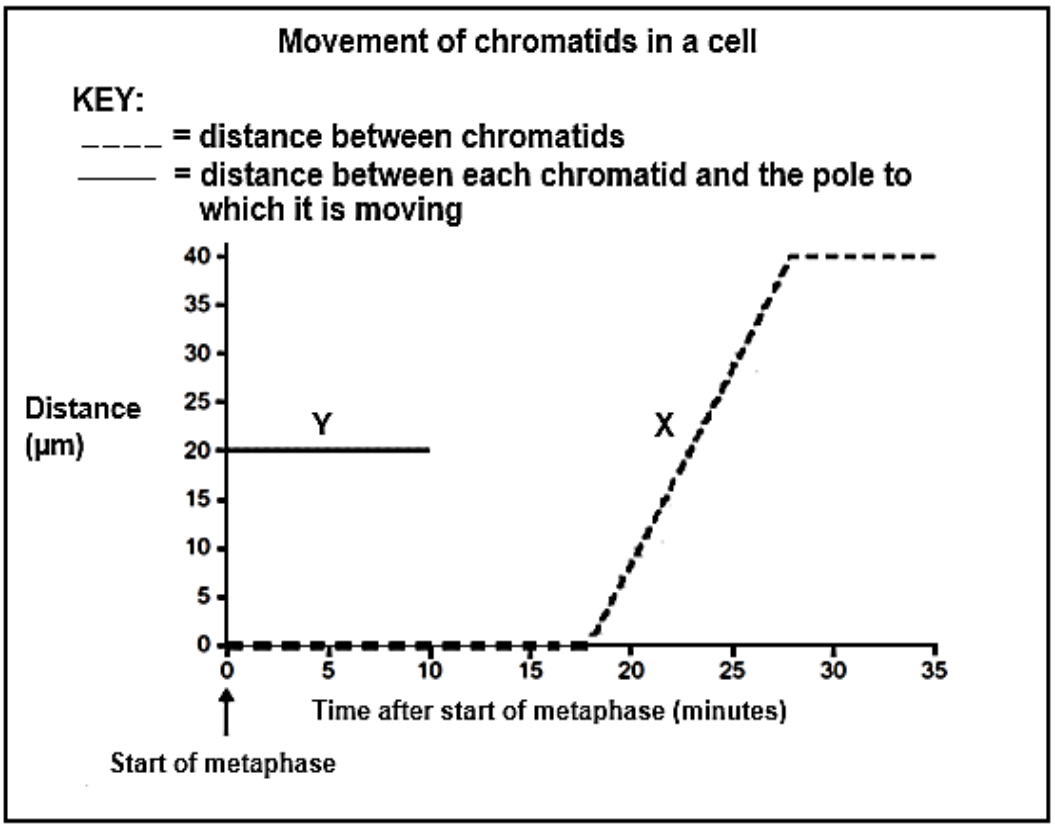
1.4.6 Which organism – *Homo erectus* or *Homo habilis* − is more closely related to modern day humans? (1)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The graph shows information about the movement of chromatids in a cell that has just started metaphase II.



2.1.1 Name ONE difference between metaphase I and metaphase II. (1)

2.1.2 What is the duration of metaphase II in this cell? (1)

2.1.3 Use line X to calculate the duration of anaphase II in this cell. (2)

2.2 Read the extract and answer the questions that follow.

MYSTERIOUS DNA

The genome is the entire DNA in all humans. The human genome has 20 000–25 000 genes and the average gene has about 3 000 bases.

The genes make up only 2% of the human genome and the rest of the DNA consists of non-coding regions. Some of them are used for regulating chromosomal structure and the quantity and quality of proteins made. The function of the 50% of the DNA, made up of repeated sequences and known as 'junk DNA', is not yet known.

Some scientist differ from the above view. According to Dr Carolyn Hancock, genes make up 5% of the human genome.

[Source: Adapted from *http://www.ornl.gov*]

2.2.1 Define the term *genome*. (2)

2.2.2 What is a gene? (2)

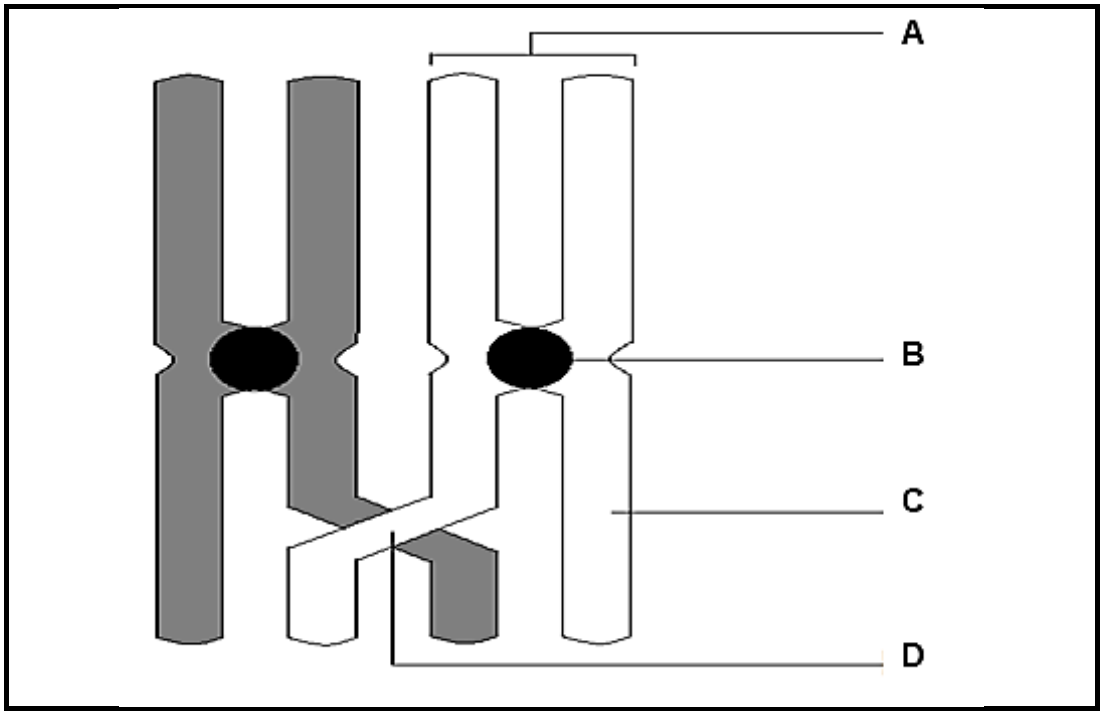
2.2.3 List TWO functions of non-coding DNA. (2)

2.2.4 (a) According Dr Carolyn Hancock, what percentage of DNA is called 'junk DNA'? (1)

(b) Why is it called "Junk DNA"? (1)

2.2.5 John's genome consists of 24 000 genes. If his first chromosome has 2 965 genes and his Y chromosome has 231 genes, calculate the total number of genes on his other chromosomes. (Show all working.) (3)

2.3 The diagram below represents a process taking place during meiosis. Study the diagram and answer the questions that follow.



2.3.1 Provide labels for parts **A, B, C** and **D**. (4)

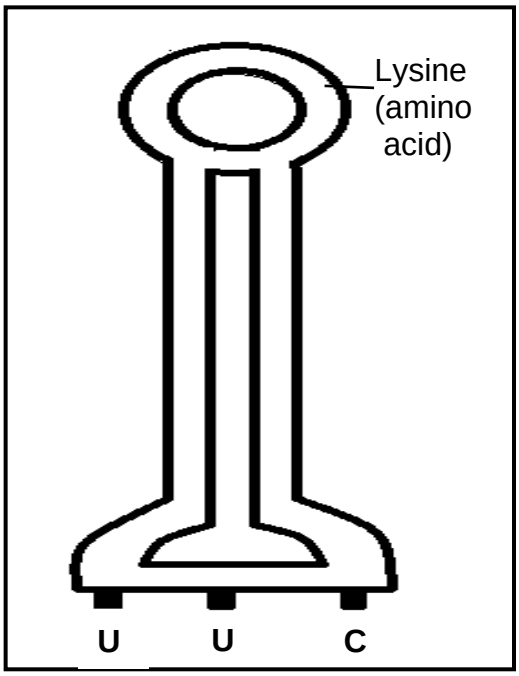
2.3.2 Name the process in meiosis that is illustrated in the diagram. (1)

2.3.3 State ONE importance of the process mentioned in QUESTION 2.3.2. (2)

2.3.4 Draw a diagram of the structure labelled A to show its appearance immediately after the process you named in QUESTION 2.3.2. (3)

2.4 The diagram below represents a molecule of transfer RNA to which an amino acid, lysine is attached.

Molecule of tRNA to which lysine is attached



Explain the function of the tRNA molecule in the above diagram. (3)

2.5 Female fruit flies are approximately 2,5 mm long. Males are smaller and possess a distinct black patch on their bodies. Females lay up to 400 eggs, which develop into adults in 7 to 14 days.

Fruit flies will survive and breed in small flasks containing a simple nutrient medium consisting mainly of sugars.

2.5.1 Use the information above to explain TWO reasons why the fruit fly is a useful organism for studying genetic crosses. (4)

2.5.2 Male fruit flies have the sex chromosomes **XY** and the females have **XX**. In the fruit fly, a gene for eye colour is carried on the **X** chromosome.

The allele for red eyes (**R**) is dominant to the allele for white eyes (**r**). A white eyed male is crossed with a homozygous red eyed female. Use a genetic cross to show the $\mathbf{F_1}$ offspring. (6)

2.5.3 Explain why male fruit flies are more likely than female fruit flies to show a phenotype produced by a recessive allele. (2)

[40]

QUESTION 3

3.1 In guinea pigs black fur is due to a dominant gene **B**, and white fur due to a recessive gene **b**. Short fur is due to a dominant gene **S**, and long fur due to a recessive gene **s**. A breeder did the following crossing: **BbSs** x **bbss**.

3.1.1 Using a genetic cross, determine the phenotype of the parents and the possible genotypes of the offspring. (6)

3.1.2 Give the phenotype and ratio of the offspring. (2)

3.2 A scientific investigation was carried out in an urban community. People were asked to rate their level of knowledge about genetically modified foods on a scale of 1 to 5. A rating of 1 means that they have very poor knowledge and a rating of 5 means that they are very knowledgeable about genetically modified foods. The table below shows the data that was collected.

Level of knowledge	**1 Poor knowledge**	**2**	**3 Some Knowledge**	**4**	**4 Excellent knowledge**
% of people surveyed	40	31	22	5	2

3.2.1 What conclusion can be drawn from the data collected? (3)

3.2.2 Predict the conclusion if it was done in a rural area. (2)

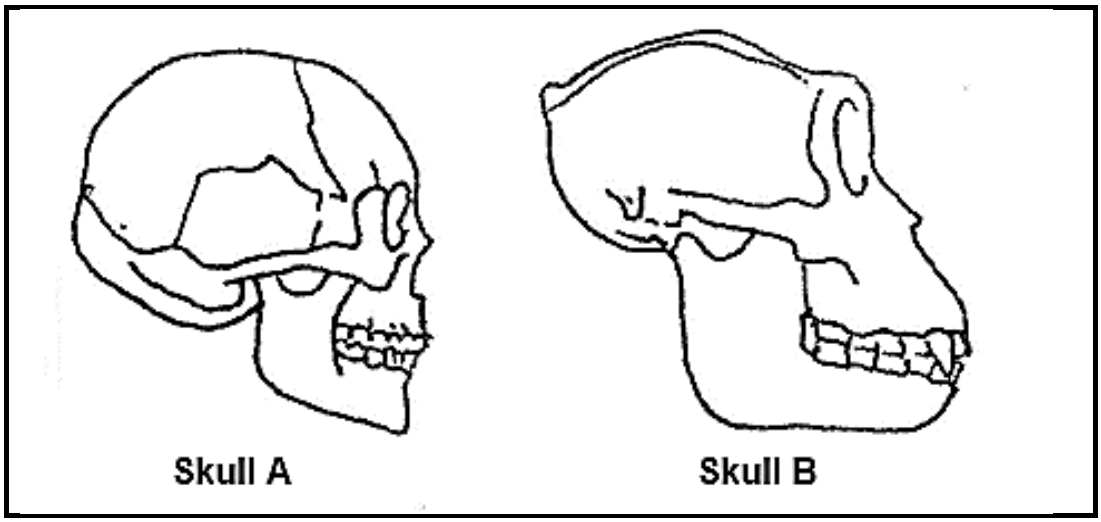
3.2.3 Write down an explanation that the scientist could have given for genetically modified food. (2)

3.2.4 Give TWO arguments each:

(a) In support of the use of genetically modified food (2)

(b) Against the use of genetically modified food (2)

3.3 Study the two skulls below and answer the questions that follow.



3.3.1 Which skull (A or B) is that of a non-human primate? (1)

3.3.2 List FIVE observable features/reasons for your answer in QUESTION 3.3.1. (5)

3.4 List THREE advantages of bipedalism. (3)

3.5 The table below shows the average brain volume for various hominids. Study the table and answer the questions that follow.

HOMINID	AVERAGE BRAIN VOLUME (CM^3)
Australopithecus afarensis	440
Australopithecus africanus	450
Homo habilis	575
Homo erectus	1 100
Homo sapiens	1 450

3.5.1 Draw a bar graph showing the average brain volume for various hominids. (6)

3.5.2 Which hominid has the largest brain volume? (1)

3.5.3 Describe the relationship between the hominid evolution and brain volume. (3)

3.5.4 State TWO advantages of a bigger brain volume. (2)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

4.1 Describe how mutation and its effects increase variation and the impact of it on natural selection. (17)

Synthesis (3)

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

TOTAL SECTION C: 20
GRAND TOTAL: 150