



Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

LIFE SCIENCES P2

PREPARATORY EXAMINATION

SEPTEMBER 2016

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MARKS: 150

TIME: 2½ hours

N.B. This question paper consists of 17 pages including this page.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in your 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. 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 may 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 to D) next to the question number (1.1.1 to 1.1.10) in your ANSWER BOOK, for example 1.1.11 D.

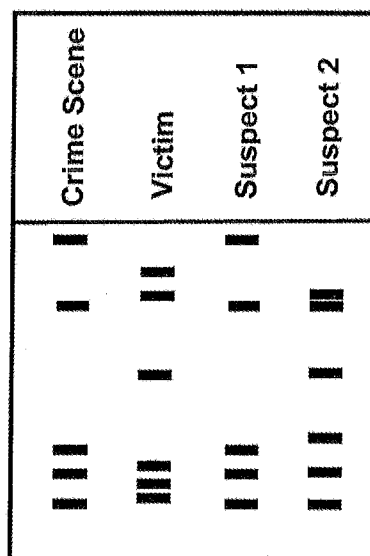
1.1.1 Which of the following is complementary to the three coding bases on an mRNA molecule?

- A Codon
- B Anticodon
- C Amino acid
- D tRNA

1.1.2 Non-disjunction sometimes occurs during the formation of gametes in a human. If an ovum with one extra chromosome is fertilized by a normal sperm cell, how many chromosomes will be present in the zygote?

- A 46
- B 47
- C 23 pairs
- D 24 pairs

1.1.3 The diagram below shows four DNA profiles.



Adapted from: <http://www.vce.bioninja.com>.

Which of the following conclusions can be made from the DNA profiles?

- A Suspect 1 was at the crime scene but suspect 2 was not
- B Suspect 2 was at the crime scene but suspect 1 was not
- C Suspect 2 committed the crime
- D Suspect 1 committed the crime

1.1.4 Which **ONE** of the following makes up a DNA nucleotide?

- A Ribose sugar, protein and phosphate
- B Deoxyribose sugar, nitrogenous base and uracil
- C Phosphate, ribose sugar and nitrogenous base
- D Nitrogenous base, phosphate and deoxyribose sugar

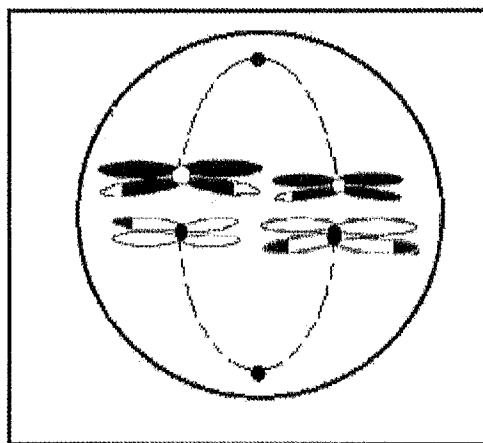
1.1.5 The only difference between the DNA of one member of a species and that of another member of the same species is the ...

- A order in which the bases occur in their chromosomes
- B type of bonds present between the bases in their chromosomes
- C type of bases present in their chromosomes
- D the number of strands that occur in their chromosomes

1.1.6 A black rabbit is crossed with a white rabbit. All of the offspring are piebald (having black and white patches). The genotypes of the parents and the offspring are ...

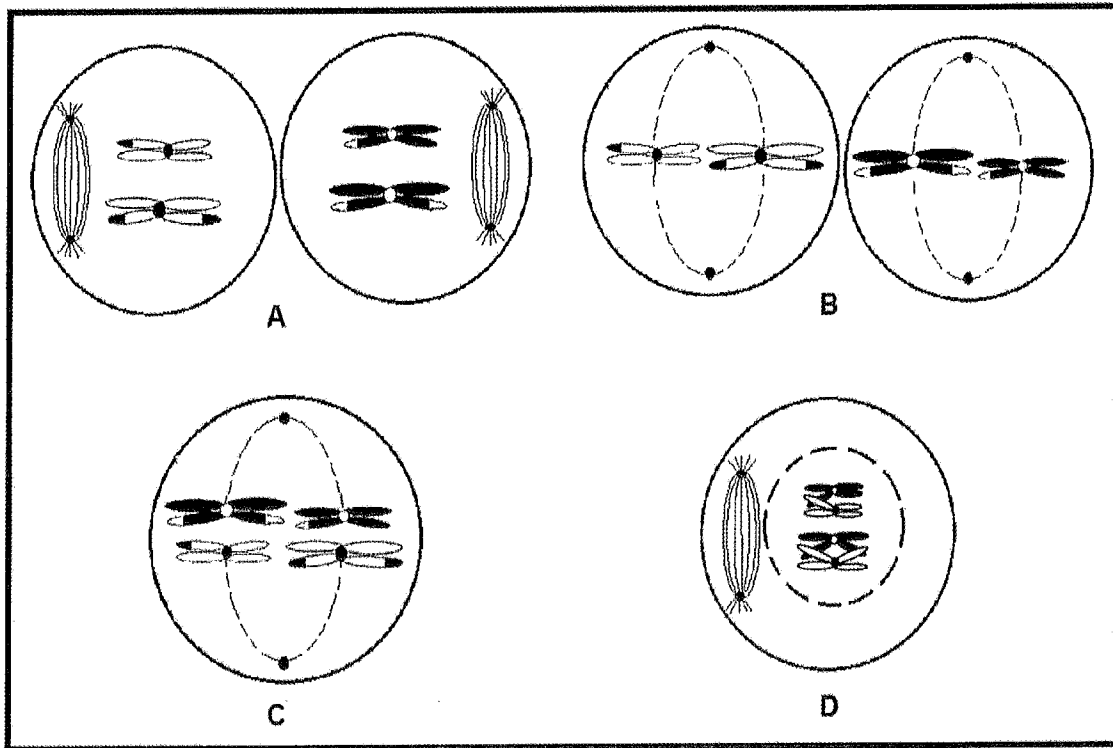
	Black Rabbit	White Rabbit	Piebald Offspring
A	BB	bb	Bb
B	ww	WW	Ww
C	BB	WW	BW
D	BW	BW	BB

1.1.7 Which of the following correctly describes **ONE** difference between the phase of meiosis shown in the diagram below and the same phase in mitosis?



	Meiosis	Mitosis
A	Centromeres attach to spindle fibres	Centromeres do not attach to spindle fibres
B	Crossing over has not taken place	Crossing over takes place
C	Centrioles are present	Centrioles are not present
D	Chromosomes are in homologous pairs	Chromosomes do not form homologous pairs

1.1.8 The diagram below shows four phases of the process of meiosis (A - D).



The correct sequence of the diagrams as they would occur during meiosis is ...

- A D, C, A, B
 B A, B, C, D
 C D, B, A, C
 D B, A, C, D

1.1.9 Study the list below that provides information about genetically modified (GM) foods:

- (i) GM foods can be made more nutritious
 (ii) GM foods could cause allergic reactions
 (iii) Biodiversity may be decreased
 (iv) GM foods may have a longer shelf-life

Which **ONE** of the following are the advantages of GM foods?

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

1.1.10 Which **ONE** of the following statements about artificial selection is correct?

- A All organisms evolve as a result of artificial selection
 B Humans choose the desired characteristic
 C The selected characteristic is always of benefit to the organism
 D Artificial selection involves genetic modification

(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 1.2.9) in your ANSWER BOOK.

1.2.1 More than two alternative forms of a gene controlling a single characteristic

1.2.2 The bond formed between amino acids

1.2.3 The original strand of a nucleic acid during DNA replication

1.2.4 An organism with two different alleles for a particular characteristic

1.2.5 The organelle, in the cytoplasm, where protein synthesis occurs.

1.2.6 Chromosomes in the cell that are sex chromosomes

1.2.7 A genetic disorder that affects the ability of the blood to clot

1.2.8 The phase of the cell cycle when DNA replication takes place

1.2.9 The structures in an animal cell that form the spindle during cell division

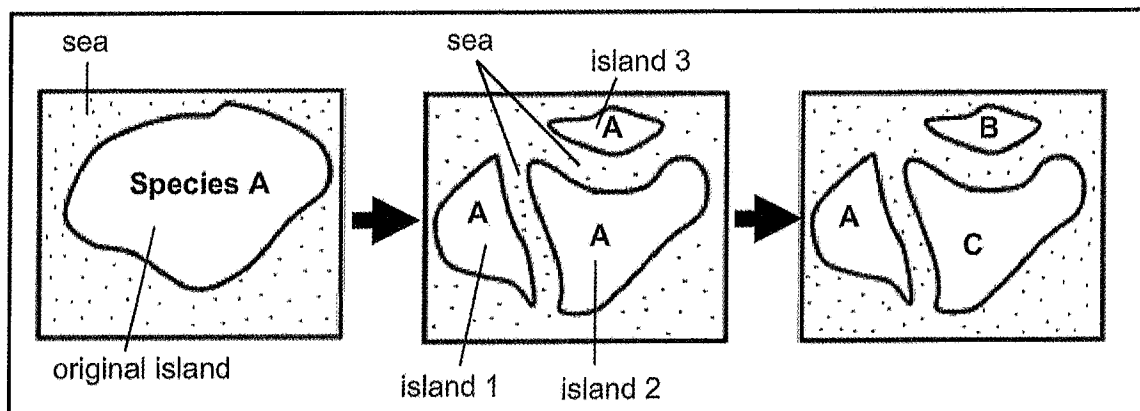
(9x1) (9)

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 (1.3.1 to 1.3.6) in the ANSWER BOOK.

	COLUMN I	COLUMN II	
1.3.1	The location of DNA in a cell	A: B:	Ribosomes Nucleus
1.3.2	A genetic cross in which both alleles are equally expressed in the phenotype	A: B:	Co-dominance Complete dominance

(2 x 2) (4)

1.4 The diagram below represents the process of speciation.



1.4.1 State each of the following:

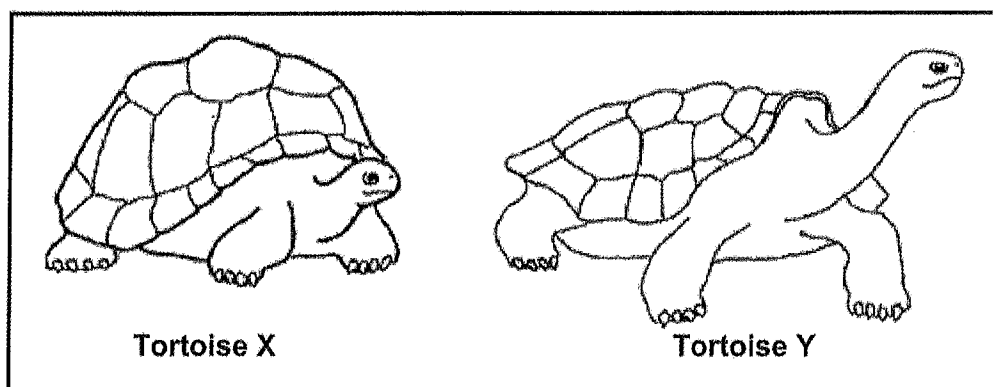
(a) The geographic barrier. (1)

(b) **TWO** ways in which variation is introduced into Species A. (2)

1.4.2 How many new species evolved from species A? (1)

1.4.3 Which island (1, 2 or 3) experienced no change in the environmental conditions? (1)

1.4.4 (a) Which of the tortoises (X or Y) shown below would have evolved on island 3 if there was no grass and the only source of food was the leaves of bushes and shrubs?



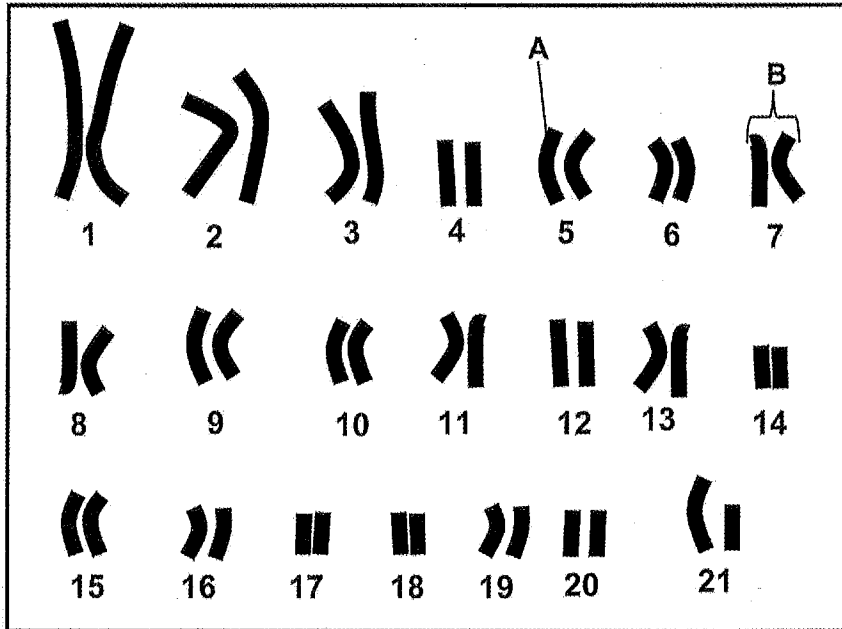
(1)

(b) List **TWO** visible structural features present in the tortoise named in QUESTION 1.4.4(a) that make it well adapted to the environment on island 3. (2)

1.4.5 If, after thousands of years the sea levels dropped and the three islands became one island again, how many species of tortoise will be present on the new island? (1)

(9)

1.5 The diagram below represents the karyotype of an organism before DNA replication has taken place.



[Adapted from : <http://www.slideshare.net>]

- 1.5.1 State **ONE** reason from the diagram that shows that this karyotype was not taken from a human. (1)
- 1.5.2 Provide a label for the part labelled **B**. (1)
- 1.5.3 How many autosomes are present in this organism's karyotype? (1)
- 1.5.4 State the sex/gender of this organism. (1)
- 1.5.5 State the number of chromosomes that will be present in each of the following cells:-
 - (a) a body cell (1)
 - (b) a gamete (1)
- 1.5.6 Name the parts that **A** is composed of after DNA replication has taken place. (2)

(8)

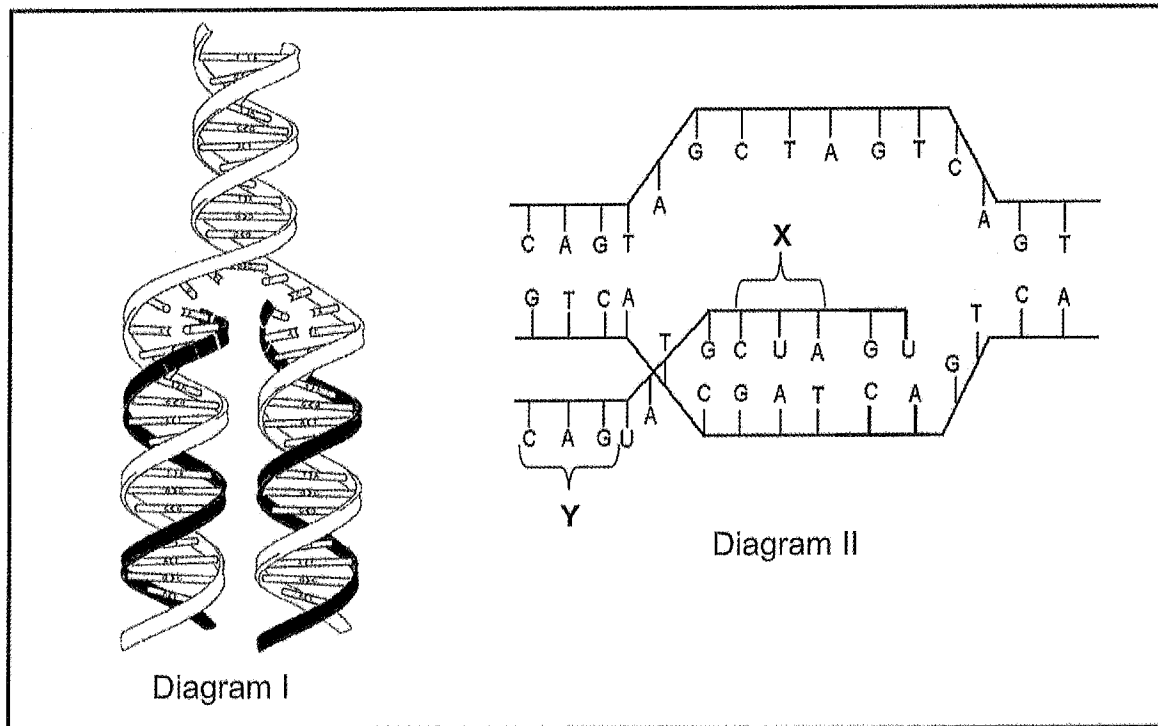
TOTAL QUESTION 1: [50]

TOTAL SECTION A: [50]

SECTION B

QUESTION 2

2.1 The diagrams below show processes of DNA replication and transcription.



2.1.1 State the molecules that are being made in diagram:

- (a) I (1)
 (b) II (1)

2.1.2 Give TWO reasons why the process occurring in diagram I is biologically important. (2)

2.1.3 Tabulate two differences in structure between the molecules made in diagram I and in diagram II. (5)

2.1.4 Use the table below to determine the amino acid that is coded for when the base triplet at Y changes to CAC.

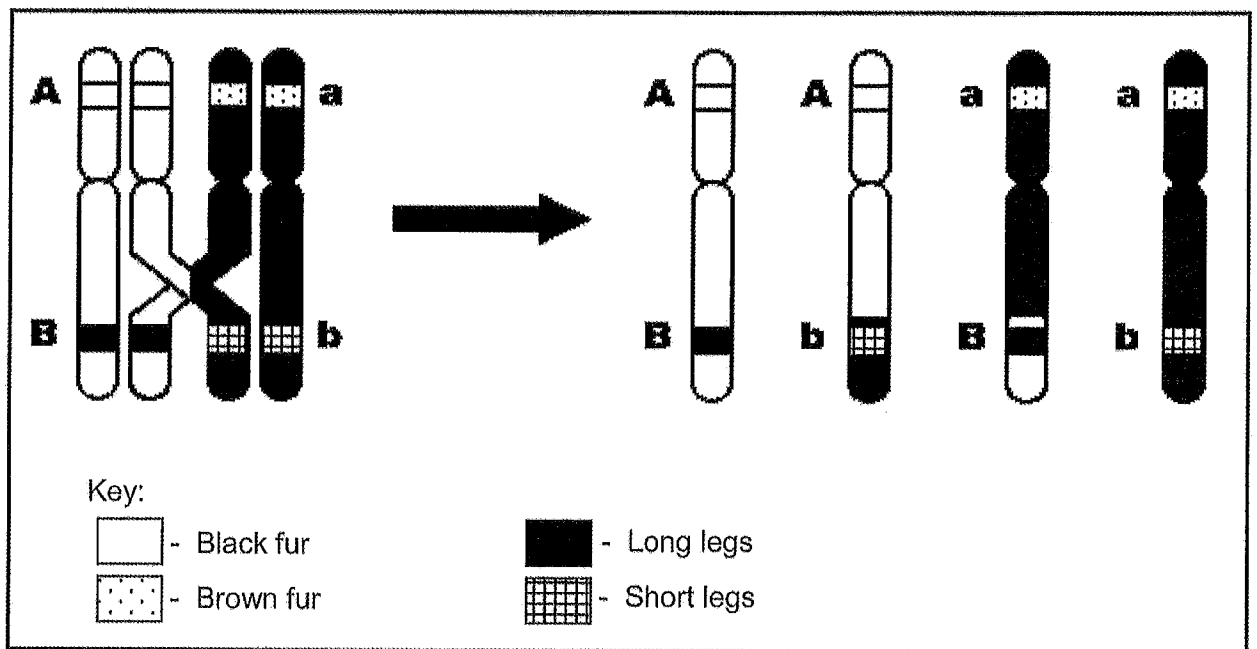
tRNA ANTICODONS	AMINO ACIDS
UUA, UUG	Leucine
CAG	Alanine
GAC	Aspartic acid
GUC	Glutamine
CCU, CCA	Proline
GUG	Valine

(2)

2.1.5 Describe the role played by the molecule being produced in diagram II in protein synthesis. (3)

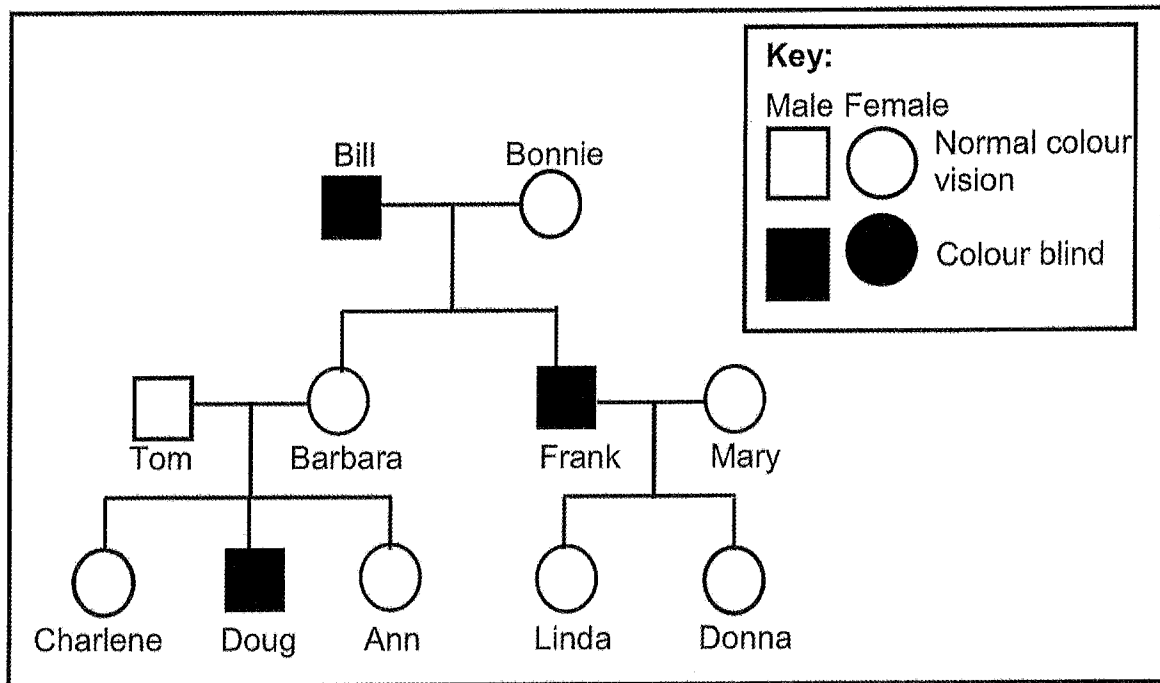
(14)

- 2.2 The diagram below shows the part of a process occurring in meiosis.
A, **B**, **a** and **b** represent alleles for different characteristics as indicated in the key below.



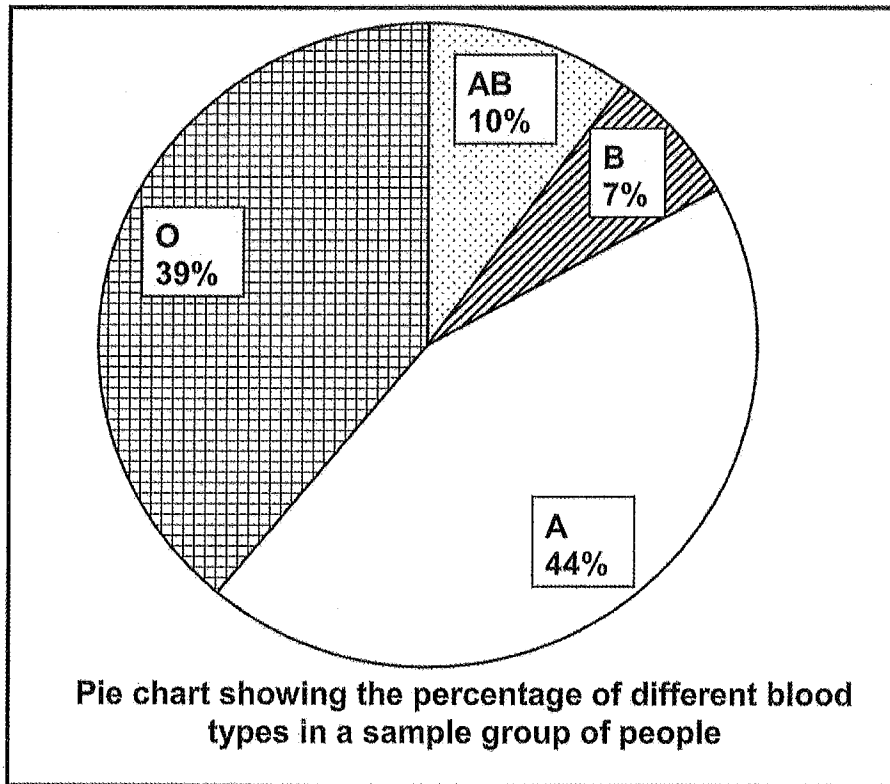
- 2.2.1 State the dominant characteristics in the diagram. (2)
- 2.2.2 Describe the process that is occurring in the diagram. (3)
- 2.2.3 Name the phase during meiosis when this process occurs. (1)
- 2.2.4 State **TWO** ways in which meiosis is significant. (2)
(8)

2.3 The diagram below represents the inheritance of colour blindness in a family.



- 2.3.1 Give evidence from the pedigree diagram that suggests that colour blindness is a sex-linked genetic disorder. (1)
- 2.3.2 What is the percentage chance that Mary and Frank's next daughter will be colour blind if Mary is a carrier of the mutation? (2)
- 2.3.3 Explain how Tom and Barbara have a son who is colour blind even though neither of them suffers from the condition. (3)
- (6)**

- 2.4 A group of learners conducted an investigation to determine which blood type is most common in humans. They recorded the blood types of the 20 learners in their class. The results are represented in the pie chart below.



- 2.4.1 State TWO planning steps that should be considered before carrying out this investigation. (2)
- 2.4.2 According to Statistics South Africa, the total population in South Africa is estimated to be 54,96 million in 2016. Use the learners results to determine how many of the South African population are likely to have blood group **B**. (2)
- 2.4.3 The frequency of each blood group worldwide is shown in the table below.

Blood Type	Worldwide Frequency (%)
O	45
A	40
B	11
AB	4

[Adapted from: www.inspired-self-help-shortcuts.com]

The learners expected their results to correspond with the results in the table above but they do not. Explain why the results of the learner's investigation are not very reliable. (2)

(6)

- 2.5 Use a genetic diagram to illustrate how a father with blood group A and a mother with blood group B could have four children, each with a different blood group. (6)

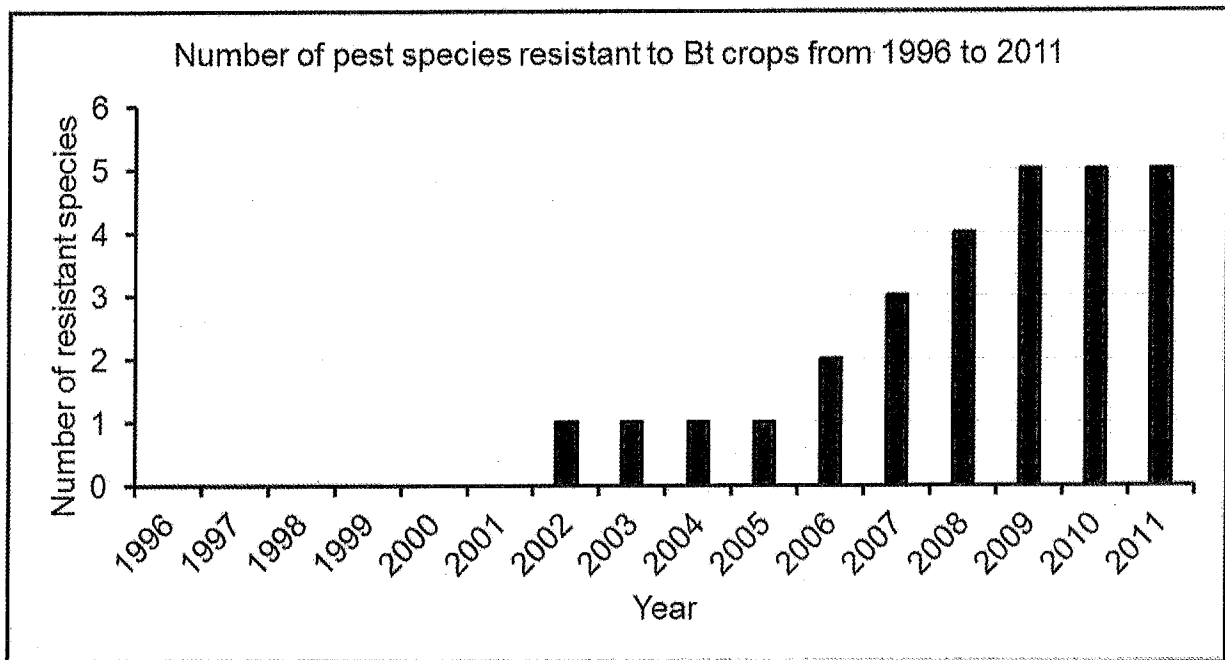
(6)

TOTAL QUESTION 2: [40]

QUESTION 3

- 3.1 Biotechnology is used to genetically modify plants. Genes from a bacterium called *Bacillus thuringiensis* could be inserted into a plant's genome. Crop plants which have been genetically modified in this way are called Bt crops. The introduction of these genes into crop plants allows them to produce proteins that kill insects that feed on the crops.

Bt crops were first introduced in 1996 and by 2011 almost 70 million hectares of land was being planted with Bt crops. The graph below shows the effect of the increased use of Bt crops on the number of insect species that are resistant to the proteins produced by the crops.



[Adapted from: www.nature.com]

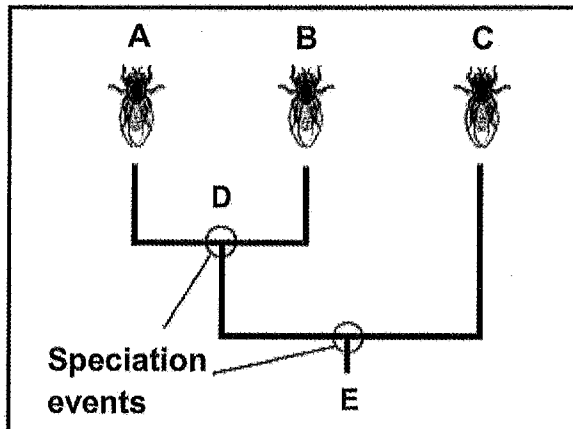
- 3.1.1 How many species of insects were resistant to Bt crops in ...

- (a) 1999? (1)
- (b) 2011? (1)

- 3.1.2 How long did it take, after the introduction of Bt crops, for resistant insect species to first appear? SHOW ALL CALCULATIONS (2)

- 3.1.3 Using your knowledge of natural selection, describe how an insect species is able to develop resistance to the Bt crops. (6)
(10)

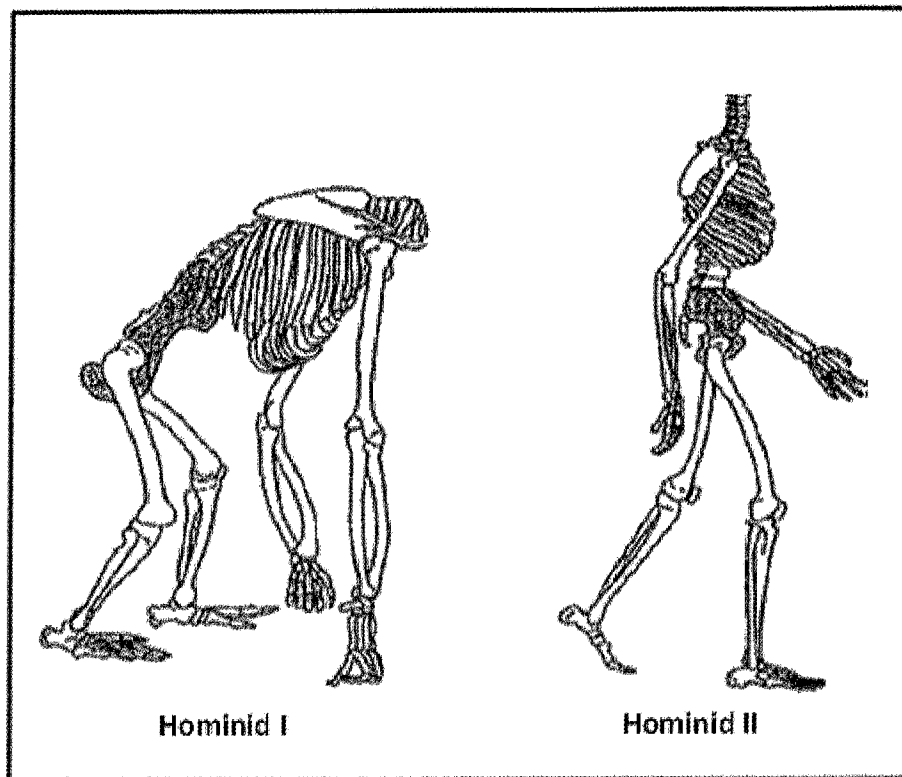
- 3.2 The phylogenetic tree below shows the evolution of three different species (A, B and C) of fruit fly.



[Adapted from: <http://evolution.berkeley.edu>]

- 3.2.1 Which letter represents the common ancestor of the three species of fruit fly? (1)
- 3.2.2 Which **TWO** species of fruit fly shown in the phylogenetic are most closely related? (1)
- 3.2.3 Name **TWO** reproductive isolating mechanisms that could have caused the speciation events. (2)
- 3.2.4 Describe how the evolution of these flies could be explained using punctuated equilibrium. (4)
(8)

3.3 The diagrams below show the skeletons of **TWO** hominids without their skulls.



3.3.1 Which hominid, I or II ...

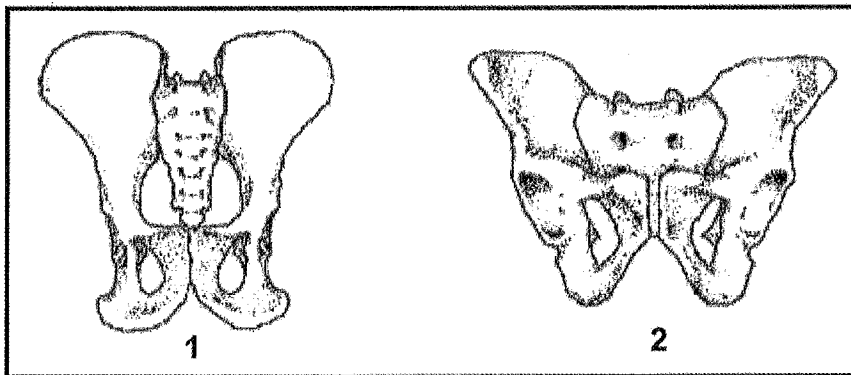
- (a) belongs to the genus Homo? (1)
- (b) has more characteristics in common with an African ape? (1)

3.3.2 List **TWO** characteristics, of the upper limbs, shared by the two hominids. (2)

3.3.3 (a) Which hominid, I or II, is bipedal? (1)

- (b) Explain **THREE** advantages of bipedalism to the hominid in QUESTION 3.3.3(a). (6)

3.3.4 The diagram below represents the pelvis associated with hominids I and II. (The diagrams are not drawn to scale)



[<https://jkendrickensis.wordpress.com>]

- (a) Which pelvis, 1 or 2, belongs to hominid II? (1)
- (b) List **TWO** characteristics of the pelvis that supports your answer in QUESTION 3.3.5(a). (2)
- (c) Describe the shape of the spine that is associated with pelvis 1. (1)
- (15)**

3.4 In humans, a person's thumb may be straight or curved (called a hitchhiker's thumb) and they may have dimples or not have dimples on their cheeks.

A man who is homozygous for straight thumbs and dimples has five children with his wife who is homozygous for curved thumbs and no dimples. All of the children have the same phenotype as their father.

Use the letters **T** and **t** for the shape of the thumb and **D** and **d** for the presence/absence of dimples.

3.4.1 Give the genotypes of the ...

- (a) father. (1)
- (b) children. (1)

3.4.3 One of the children marries a person with the same genotype as them and their first child has curved thumbs and no dimples. Explain how this is possible. (3)

3.4.4 Explain why males and females have an equal chance of inheriting curved thumbs from their parents. (2)

(7)

TOTAL QUESTION 3: [40]

TOTAL SECTION B: [80]

SECTION C**QUESTION 4**

4. Describe the 'Out of Africa' hypothesis and how it is supported by comparing evolutionary trends visible in the fossil skulls of, *Ardipithecus*, *Australopithecus* and *Homo* species as well as how studies of mitochondrial DNA supports this hypothesis.

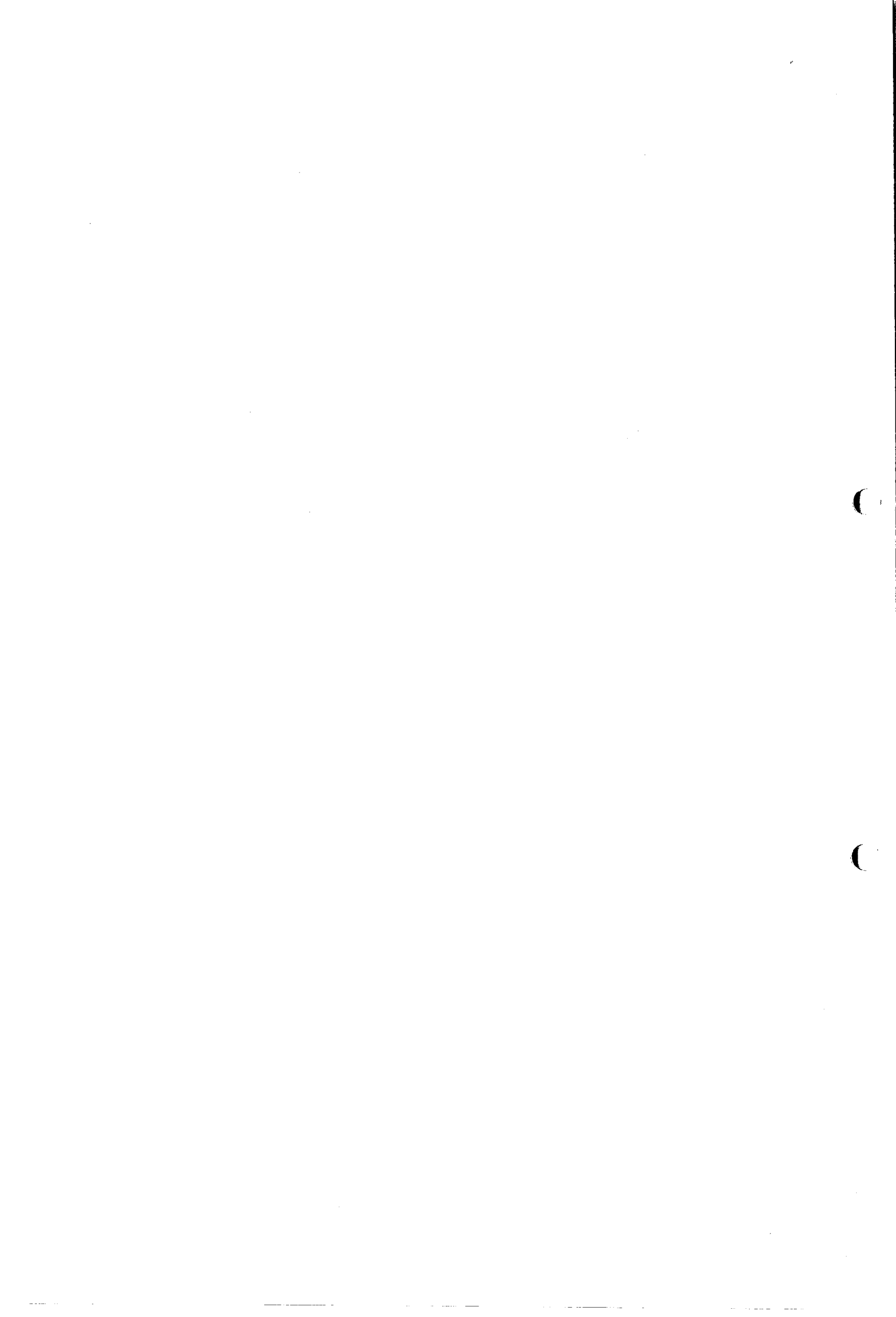
Content: (17)

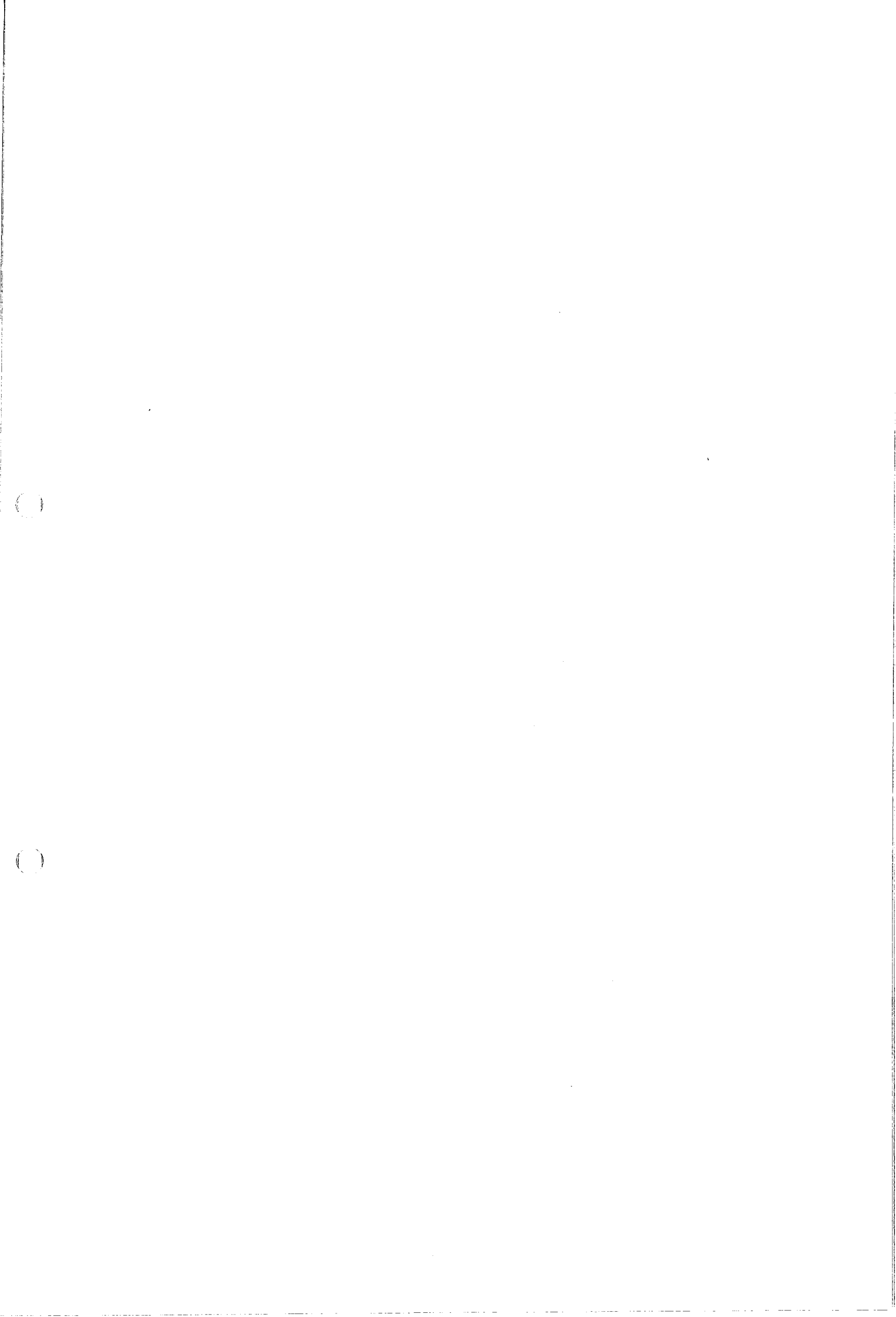
Synthesis: (3)

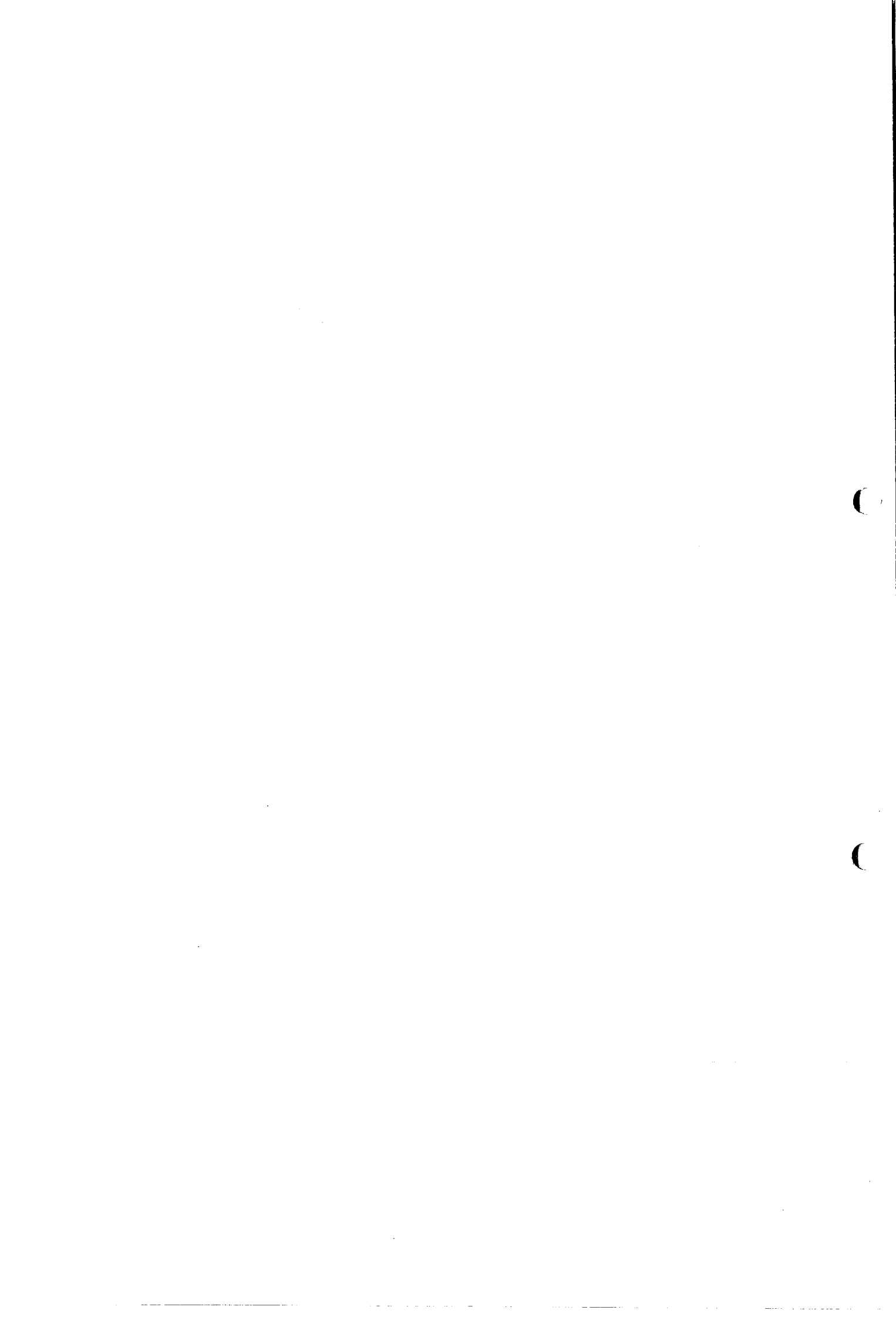
(20)

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

TOTAL SECTION C: [20]**GRAND TOTAL: 150**







PRINCIPLES RELATED TO MARKING LIFE SCIENCES 2016

1. **If more information than marks allocated is given**
Stop marking when maximum marks is reached and put a wavy line and 'max' in the right-hand margin.
2. **If, for example, three reasons are required and five are given**
Mark the first three irrespective of whether all or some are correct/incorrect.
3. **If whole process is given when only part of it is required**
Read all and credit relevant part.
4. **If comparisons are asked for and descriptions are given**
Accept if differences / similarities are clear.
5. **If tabulation is required but paragraphs are given**
Candidates will lose marks for not tabulating.
6. **If diagrams are given with annotations when descriptions are required**
Candidates will lose marks
7. **If flow charts are given instead of descriptions**
Candidates will lose marks.
8. **If sequence is muddled and links do not make sense**
Where sequence and links are correct, credit. Where sequence and links is incorrect, do not credit. If sequence and links becomes correct again, resume credit.
9. **Non-recognised abbreviations**
Accept if first defined in answer. If not defined, do not credit the unrecognized abbreviation but credit the rest of answer if correct.
10. **Wrong numbering**
If answer fits into the correct sequence of questions but the wrong number is given, it is acceptable.
11. **If language used changes the intended meaning**
Do not accept.
12. **Spelling errors**
If recognizable accept provided it does not mean something else in Life Sciences or if it is out of context.



Basic Education

KwaZulu-Natal Department of Basic Education
REPUBLIC OF SOUTH AFRICA

LIFE SCIENCES P2
MEMORANDUM
PREPARATORY EXAMINATION
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**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MARKS: 150

TIME: 2½ hours

N.B. This memorandum consists of 12 pages including this page.

SECTION A**QUESTION 1**

- 1.1
- 1.1.1 B✓✓
 - 1.1.2 B✓✓
 - 1.1.3 A✓✓
 - 1.1.4 D✓✓
 - 1.1.5 A✓✓
 - 1.1.6 C✓✓
 - 1.1.7 D✓✓
 - 1.1.8 A✓✓
 - 1.1.9 B✓✓
 - 1.1.10 B✓✓

1.2

- 1.2.1 Multiple alleles ✓
- 1.2.2 Peptide ✓
- 1.2.3 Templates ✓
- 1.2.4 Heterozygous ✓
- 1.2.5 Ribosome ✓
- 1.2.6 Gonosomes ✓
- 1.2.7 Haemophilia ✓
- 1.2.8 Interphase ✓
- 1.2.9 Centrioles ✓/centrosome

(10 x 2) (20)

(9 x 1) (9)

13. **If common names given in terminology**

Accept provided it was accepted at the National memo discussion meeting.

14. **If only letter is asked for and only name is given (and vice versa)**

No credit

15. **If units are not given in measurements**

Candidates will lose marks. Memorandum will allocate marks for units separately

16. **Be sensitive to the sense of an answer, which may be stated in a different way.**17. **Caption**

All illustrations (diagrams, graphs, tables, etc.) must have a caption

18. **Code-switching of official languages (terms and concepts)**

A single word or two that appears in any official language other than the learners' assessment language used to the greatest extent in his/her answers should be credited, if it is correct. A marker that is proficient in the relevant official language should be consulted. This is applicable to all official languages.

SECTION B

QUESTION 2

2.1

- 2.1.1 (a) I – DNA ✓ (1)
- (b) II – mRNA ✓ (1)

2.1.2 DNA replication ensures that...

- each new cell formed by mitosis gets a complete copy of the genetic material of the original cell ✓
- that genetic material received by new cells is identical to the original DNA ✓ (2)

2.1.3 ✓

Diagram I (DNA)	Diagram II (RNA)
1. Double stranded ✓ / base pairing	1. Single stranded ✓ / no base pairing
2. Contains thymine ✓	2. Contains uracil ✓
3. Forms a helix shape ✓	3. Is a straight molecule ✓
4. A=T and G=C ✓ /	4. There is not set pattern to the bases ✓
5. Contains deoxyribose sugar ✓	5. Contains ribose sugar ✓
6. Long molecule ✓	6. Short molecule ✓

(Mark first TWO only)

(1+ any 2 x 2)

2.1.4 Valine ✓ ✓ (2)

- 2.1.5 - The molecule/mRNA carries the genetic code ✓
- from the DNA ✓ in the nucleus
- to the ribosome ✓ in the cytoplasm
- where it is translated ✓ / to allow t-RNA to bring the required amino acids (Any 3) (3)

(14)

1.3

1.3.1 B only ✓ ✓

1.3.2 A only ✓ ✓ (2 x 2) (4)

1.4

1.4.1 (a) The sea ✓ / water/ocean (1)

- (b) - Crossing over ✓ during meiosis
- Random arrangement of chromosomes ✓ at the equator during meiosis
- Random mating ✓
- (Chance) fertilization ✓
- Mutations ✓

(Mark first two only)

Any 2 (2)

1.4.2 Two ✓ / 2 (1)

1.4.3 1 ✓ (1)

1.4.4 (a) Y ✓ (1)

- (b) - Long neck ✓
- Shell curves up at the back of the neck ✓
- Front legs are longer ✓

(Mark first two only)

Any 2 (2)

1.4.5 Three ✓ / 3 (1)

(9)

1.5 1.5.1 There are only 21 pairs of chromosomes ✓ / 42 chromosomes / fewer chromosomes than in a human / does not have 23 pairs / 46 chromosomes (1)

1.5.2 Homologous pair ✓ of chromosomes (1)

1.5.3 40 ✓ / 20 pairs (1)

1.5.4 Male ✓ (1)

1.5.5 (a) 42 ✓ / 21 pairs (1)

(b) 21 ✓ (1)

1.5.6 Two chromatids ✓
Centromere ✓ (2)

(8)

TOTAL QUESTION 1: [50]

TOTAL SECTION A: [50]

2.5

P₁ Phenotype Blood group A x Blood group B ✓
 Genotype I^A I^A x I^B I^B ✓
Meiosis
G/gametes I^A, i x I^B, i ✓
Fertilisation
F₁ Genotype I^AI^B, I^Ai, I^Bi, ii ✓
 Phenotype AB : A : B : O ✓
P₁ and F₁ ✓
Meiosis and fertilisation ✓

Any 6

OR

P₁ Phenotype Blood group A x Blood group B ✓
 Genotype I^A I^A x I^B I^B ✓

Meiosis

Fertilisation

Gametes	I ^A	i
I ^B	I ^A I ^B	I ^B i
i	I ^A i	ii

1 mark for correct gametes
1 mark for correct genotypes

F₁ Phenotype AB : A : B : O ✓

P₁ and F₁ ✓
Meiosis and fertilisation ✓

Any 6

(6)

(10)

TOTAL QUESTION 2: [40]

2.2

2.2.1 Black fur ✓ and long legs ✓ (2)
 2.2.2 - Crossing over ✓ is taking place
 - Homologous chromosomes touch ✓ / overlap
 - at points called chiasma ✓ / chiasmata
 - and genetic information is exchanged ✓ (Any 3) (3)
 2.2.3 Prophase I ✓ (1)
 2.2.4 - it reduces the number of chromosomes by half ✓ / diploid to haploid /
 - balances the doubling effect of fertilisation / formation of gametes
 - crossing over introduces genetic variation ✓ (2) (8)

2.3

2.3.1 Only the males in the family suffer from colour blindness ✓ (1)
 2.3.2 50 ✓ ✓ (2)
 2.3.3 - Barbara is a carrier ✓ / heterozygous and does not suffer from colour
 blindness
 - Their son received a Y chromosome from his father ✓ /
 Tom / no allele on Y chromosome for colour blindness
 - but an X chromosome with the allele for colour blindness
 from his mother ✓ / Barbara (3) (6)

2.4

2.4.1 - Get permission from all stakeholders ✓
 - Design a record sheet ✓
 - Set a date / time ✓
 - Arrange a venue ✓
 - Determine the composition of the sample ✓ / participants
 - Ensure that the learners know their blood groups ✓ / have a means to
 determine blood groups of learners (Any 2) (2)
(Mark first TWO only)

2.4.2

$$\frac{7}{100} \times 54,96 \text{ million} \checkmark = 3,85 \checkmark / 3,9 \text{ million}$$

OR

$$\frac{7}{100} \times 54\,960\,000 \checkmark = 3\,847\,200 \checkmark$$

2.4.3 The sample that was used was very small ✓ and is therefore not
 representative of the world population ✓ (2) (6)

3.3

- 3.3.1 (a) II ✓ (1)
- (b) I ✓ (1)

- 3.3.2 - Arms rotate freely at the shoulder joint ✓
- Long upper arms ✓
- Arms rotate freely around the elbow joint ✓
- Opposable thumbs ✓
- Bare fingertips ✓
- Nails instead of claws ✓
- (Mark first TWO only)

Any 2 (2)

- 3.3.3 (a) II ✓ (1)

- (b) - The hominid stands higher ✓ to get a better view ✓
- It frees hands ✓ for hunting/to use tools, hold their young ✓
- A larger surface area is exposed to the air ✓ so the body cools faster ✓
- Bipedalism is a more efficient form of locomotion ✓ so the hominids can travel further ✓ /longer
- Standing upright displays of sex organs ✓ for courtship/ attracting mates ✓

Any (3 x 2) (6)

- 3.3.4 (a) 2 ✓ (1)
- (b) The pelvis is short ✓ /wide ✓ / cup-shaped ✓ (2)
- (c) C-shaped ✓ (1)

any 2 (15)

3.4

- 3.4.1 (a) TTDD ✓ (1)
- (b) TtDd ✓ (1)

- 3.4.3 - Each parent is heterozygous ✓
- for both characteristics ✓
- They each contribute a recessive allele for both characteristics ✓
- Therefore, their child is homozygous for both recessive characteristics ✓

Any 3 (3)

- 3.4.4 - The alleles occur on the autosomes ✓ / these characteristics are not sex-linked (2)
- offspring will inherit an allele from each parent ✓ (7)

TOTAL QUESTION 3: [40]

TOTAL SECTION B: [80]

QUESTION 3

- 3.1 3.1.1 (a) 0 ✓ (1)
- (b) 5 ✓ (1)
- 3.1.2 2002 – 1996 ✓ = 6 years ✓ (2)

- 3.1.3 - There is variation ✓ within the species
- Some insects are resistant to the Bt crops ✓
- while others are susceptible ✓ /not resistant
- The insects that are susceptible die ✓
- The insects that are resistant survive ✓
- and reproduce ✓
- and pass the on the resistant characteristic to their offspring ✓
- Eventually the whole population is made up of resistant insects ✓

Any 6 (6)

(10)

3.2

- 3.2.1 E ✓ (1)

- 3.2.2 A and B ✓ (1)

- 3.2.3 - Breeding at different times of the year ✓
- Species-specific courtship behaviour ✓
- Adaptations to different pollinators ✓
- Infertile offspring ✓

Any 2 (2)

- 3.2.4 -

- It involved long periods of time where the species did not change ✓ /there was very little change
- This alternated with short periods of time where rapid change occurred ✓
- through natural selection ✓
- resulting in new species forming in a short period of time ✓
- there will be few / no transitional species ✓

Any 4 (4)

(8)

Marks for synthesis		
Relevance (R)	Logical sequence (L)	Comprehensive (C)
All information provided is relevant to the topic	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
Only information regarding: - Out of Africa hypothesis - Trends in fossil skulls - Mitochondrial DNA No irrelevant information	Description of each of the following in a logical manner: - Out of Africa hypothesis - Trends in fossil skulls - Mitochondrial DNA	At least the following points should be included: - Out of Africa hypothesis (2/2) - Trends in fossil skulls (8/12) - Mitochondrial DNA (2/3)
1 mark	1 mark	1 mark

Content (17)
Synthesis (3)
(20)

TOTAL SECTION C: [40]

GRAND TOTAL: 150

SECTION C

QUESTION 4

Possible answer

Out of Africa Hypothesis

- The ancestors of modern humans ✓ / *Ardipithecus/ Australopithecus/ Homo habilis/ Homo erectus* evolved in Africa ✓
 - *H. erectus* migrated out of Africa ✓ / into Europe/ into the rest of the world
 - The *H. erectus* that remained in Africa ✓ continued to evolve into *H. sapiens* ✓
 - *H. sapiens* then migrated out of Africa ✓ / into Europe / into the rest of the world
- Max 2

Trends visible in fossil skulls from *Ardipithecus*, to *Australopithecus* to *Homo* species

- prominent brow ridges ✓ to having small /no brow ridges ✓
 - well developed prognathous ✓ / protruding jaws to having no prognathous ✓
 - small cranial capacities ✓ to having a large cranial capacity ✓
 - large canines ✓ / teeth to having small canines ✓ / teeth
 - having U-shaped jaws ✓ to having C-shaped jaws ✓
 - having gaps between the teeth ✓ / diastema to having no gaps/diastema between the teeth ✓
 - well developed cranial ridges ✓ to having reduced/no cranial ridges ✓
 - having large jaws ✓ to having small jaws ✓
 - the foramen magnum at the back of the skull ✓ to it being centrally situated underneath the skull ✓
- Max 12

Mitochondrial DNA

- Mitochondrial DNA is passed from mother to child ✓
 - Mutations ✓ that occur on the DNA
 - will be present in all the descendants ✓ of a particular woman
 - All people on Earth have a certain mutation on their DNA ✓
 - which can be traced to a single female ancestor that lived in Africa ✓
- Max 3

Content (17)
Synthesis (3)
(20)