



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**LIFE SCIENCES P2  
NOVEMBER 2015**

**MARKS: 150**

**TIME: 2½ hours**

**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 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 must use a non-programmable calculator, protractor and a compass, where necessary.
11. Write neatly and legibly.

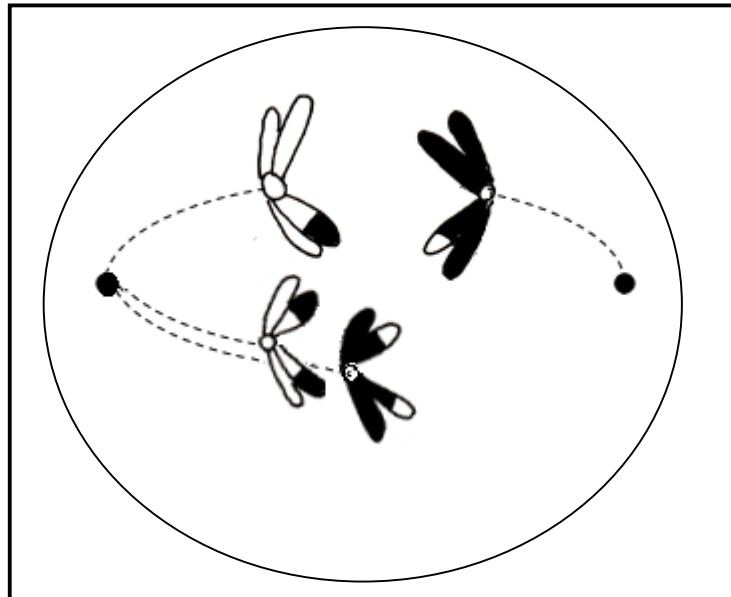
**SECTION A****QUESTION 1**

1.1 Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.9) in the ANSWER BOOK, for example 1.1.10 D.

1.1.1 Cells that can differentiate into any type of cell are called ...

- A sex cells.
- B daughter cells.
- C stem cells.
- D haploid cells.

1.1.2 The diagram below shows a cell undergoing meiosis.



The diagram above shows ...

- A non-disjunction in metaphase II.
- B a chromosomal aberration that results in haemophilia.
- C a chromosomal aberration involving chromosome pair number 23, leading to Down syndrome.
- D non-disjunction in anaphase I.

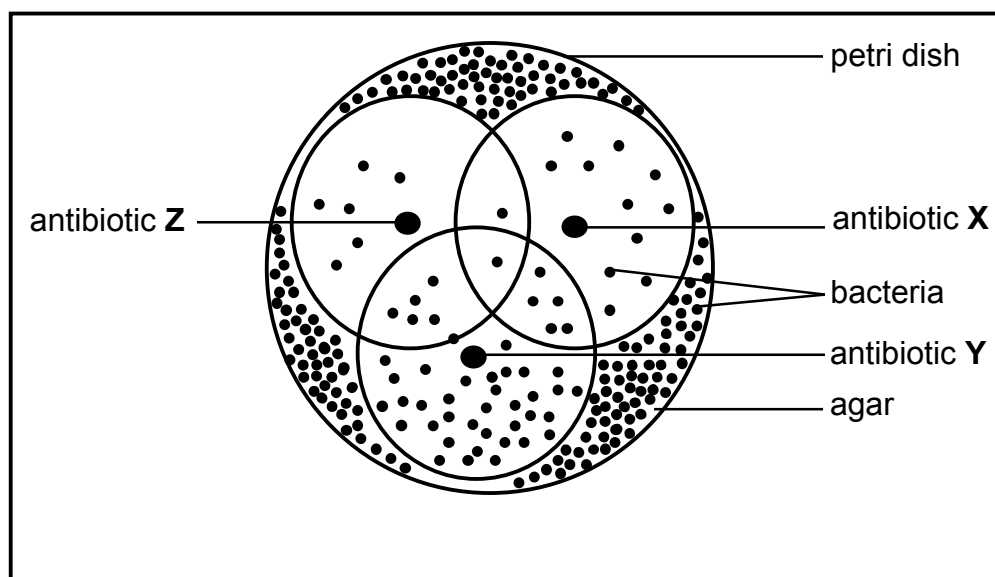
1.1.3 The DNA of different species only differs in the ...

- A components of the nucleotides.
- B sequence of the nucleotides.
- C type of bond between the nitrogenous bases.
- D type of sugar that it contains.

1.1.4 One strand of a DNA molecule has 60 adenine and 20 thymine molecules. How many adenine molecules are present in the double-stranded DNA molecule?

- A 60
- B 150
- C 80
- D 300

1.1.5 The diagram below shows the effect of three different types of antibiotic (X, Y and Z) on a single strain of bacterium growing on agar (nutrient jelly) in a petri dish. The three circles indicate the distance to where each antibiotic spread.



The correct order of the antibiotics, from most effective to least effective, is ...

- A Z, X and Y.
- B X, Y and Z.
- C X, Z and Y.
- D Z, Y and X.

1.1.6 A trait that has a range of phenotypes is an example of ...

- A continuous variation.
- B discontinuous variation.
- C complete dominance.
- D codominance.

- 1.1.7 In the most stable freshwater environments populations of *Daphnia* are almost entirely female and reproduce asexually. However, males are observed in low-oxygen environments or when food is scarce.

Based on these observations, a researcher suggests at the start of an experiment that:

Male *Daphnia* only develop in response to unfavourable environmental conditions.

This is an example of a/an ...

- A conclusion.
- B hypothesis.
- C theory.
- D aim.

**QUESTIONS 1.1.8 AND 1.1.9 REFER TO THE INFORMATION BELOW.**

In pea plants yellow seed colour (Y) is dominant over green seed colour (y). Smooth seed texture (S) is dominant over wrinkled seed texture (s).

A student crossed a plant which had yellow wrinkled seeds with a plant which had green smooth seeds.

- 1.1.8 Which ONE of the following shows possible alleles present in a gamete that is produced by the plant with yellow wrinkled seeds?

- A YYss
- B yySS
- C yS
- D Ys

- 1.1.9 Which ONE of the following is a possible representation of the genotypes of the P<sub>1</sub> generation?

- A YYSS x yyss
- B Yyss x yySs
- C YYSS x yySs
- D Yyss x YySs

(9 x 2)

**(18)**

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 the ANSWER BOOK.

- 1.2.1 Chromosomes that carry the same set of genes
- 1.2.2 Two or more alternative forms of a gene at the same locus
- 1.2.3 The structure responsible for pulling chromosomes to the poles of an animal cell during cell division
- 1.2.4 A phase in the cell cycle that occurs before cell division
- 1.2.5 A diagrammatic representation showing possible evolutionary relationships among different species
- 1.2.6 The type of vision shared by apes and humans that allows for depth perception
- 1.2.7 A genetic cross involving two characteristics
- 1.2.8 A genetic disorder characterised by the absence of a blood-clotting factor
- 1.2.9 The present-day distribution of organisms (9)

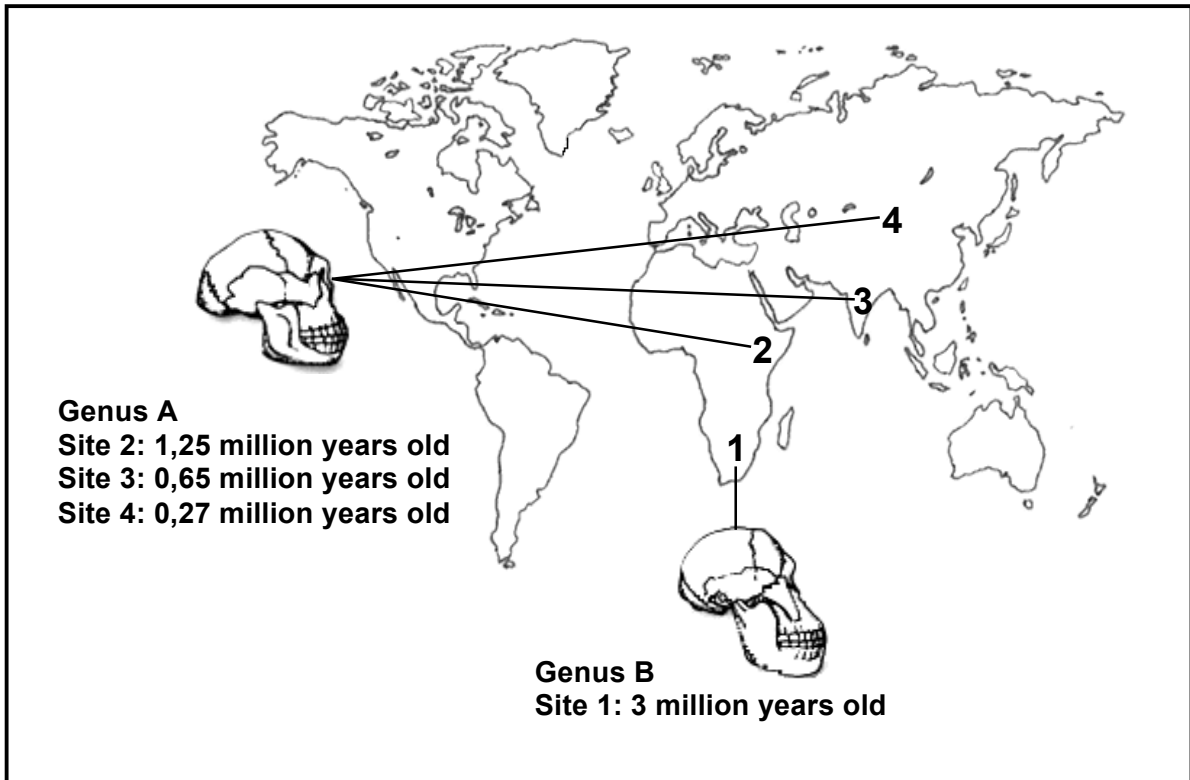
1.3 Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question number (1.3.1 to 1.3.4) in the ANSWER BOOK.

COLUMN I		COLUMN II
1.3.1	Produced the first X-ray pictures of DNA	A: Watson B: Franklin
1.3.2	An example of biotechnology	A: Genetic modification B: Cloning
1.3.3	Law of inheritance of acquired characteristics	A: Darwin B: Lamarck
1.3.4	All the genes in all the chromosomes of a species	A: Genome B: Genotype

(4 x 2)

(8)

1.4 The diagram below shows a world map indicating four sites (1 to 4) where hominid fossils, representing two different genera, have been found. Genus **A** was found at three sites and genus **B** at one site. The age of each fossil was determined using radiometric dating.



[Adapted from [www.biologyreference.com](http://www.biologyreference.com)]

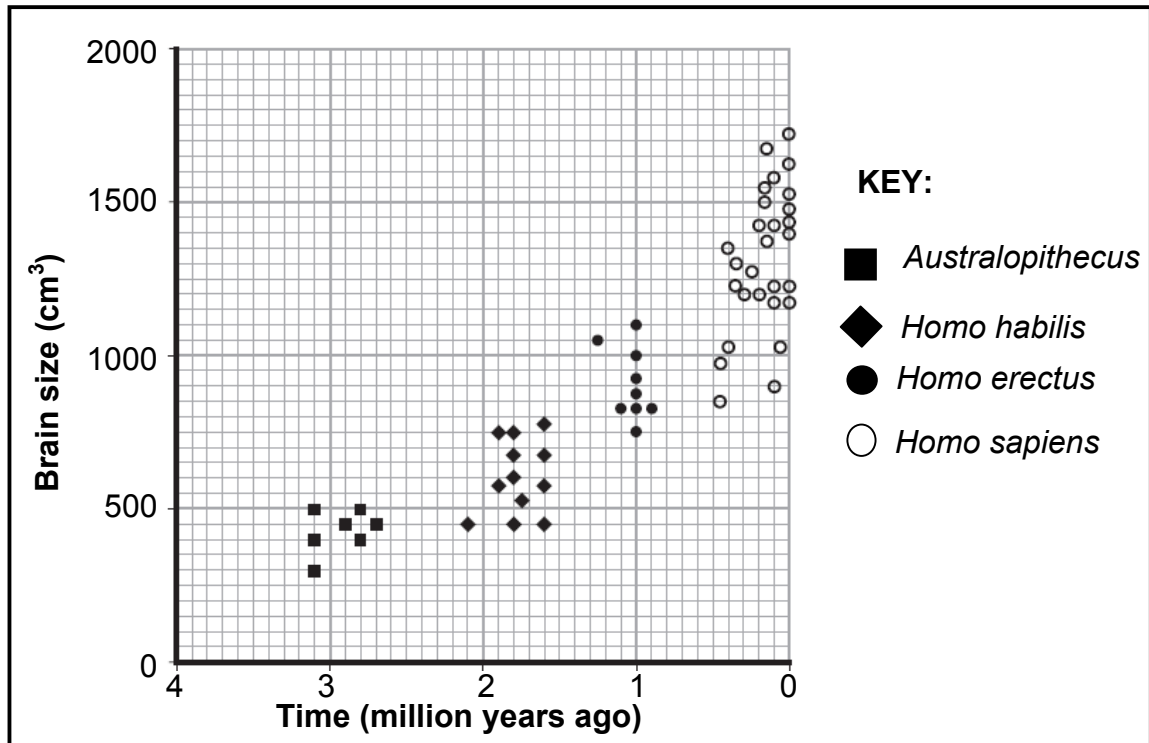
- 1.4.1 Which genus (**A** or **B**):
- (a) Represents *Australopithecus* (1)
  - (b) Had a more prognathous skull (1)
  - (c) Had smaller canines (1)
  - (d) Is more closely related to *Homo sapiens* (1)
- 1.4.2 Name TWO examples of fossils of genus **B** found at site 1 in South Africa. (2)
- 1.4.3 At which site, 1 to 4, were the youngest fossils found? (1)
- 1.4.4 Other than fossil evidence, what other evidence can be used to support the Out of Africa hypothesis? (1)

(8)

1.5 Scientists estimated the brain sizes of *Australopithecus*, *Homo habilis*, *Homo erectus* and *Homo sapiens* by using the cranial capacity of fossil specimens. They then compared their results to the time that each hominid existed on earth.

The graph below represents the range of brain size and the time period that the hominid existed according to fossil evidence.

The results of the investigation are shown on the graph below.



[Adapted from AQA-BLY1B-W-QP-NOV07 Unit 1b]

1.5.1 According to the graph:

(a) When did the first *Australopithecus* appear (2)

(b) Which of the species shows the greatest variation in brain size (1)

1.5.2 Give the size (in cm<sup>3</sup>) of the:

(a) Largest brain of *Australopithecus* (1)

(b) Smallest brain of *Homo sapiens* (1)

1.5.3 State TWO types of evidence, other than fossils, that support the idea that all hominids evolved from a common ancestor. (2)

(7)

**TOTAL SECTION A: 50**

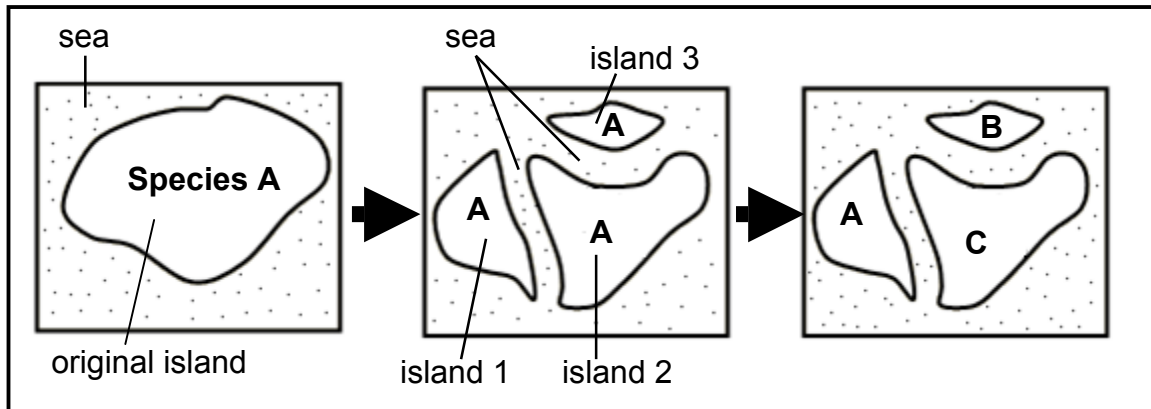


**SECTION B**

**QUESTION 2**

2.1 The diagrams below represent the process of speciation in tortoises.

Over a period of time species **B** and **C** evolved from species **A**.



2.1.1 Explain why species **A** continued to exist on island 1. (2)

2.1.2 Describe how species **B** and **C** evolved from species **A**. (6)  
(8)

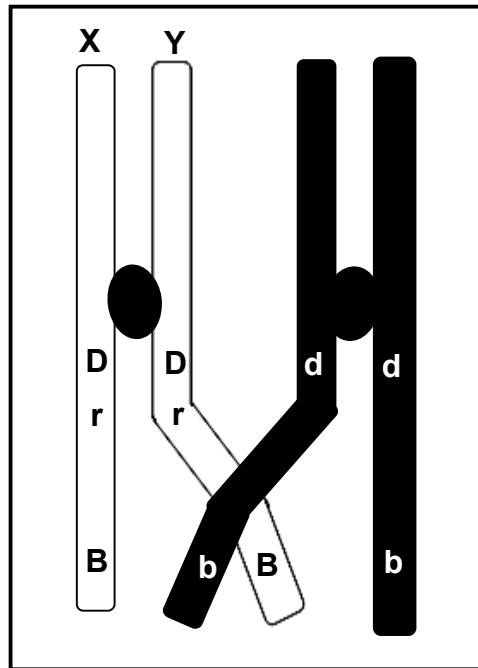
2.2 The father of a child can be determined by analysing blood groups.

2.2.1 Explain how an analysis of blood groups can be used to determine paternity. (5)

2.2.2 A man and a woman both have blood group **B**.

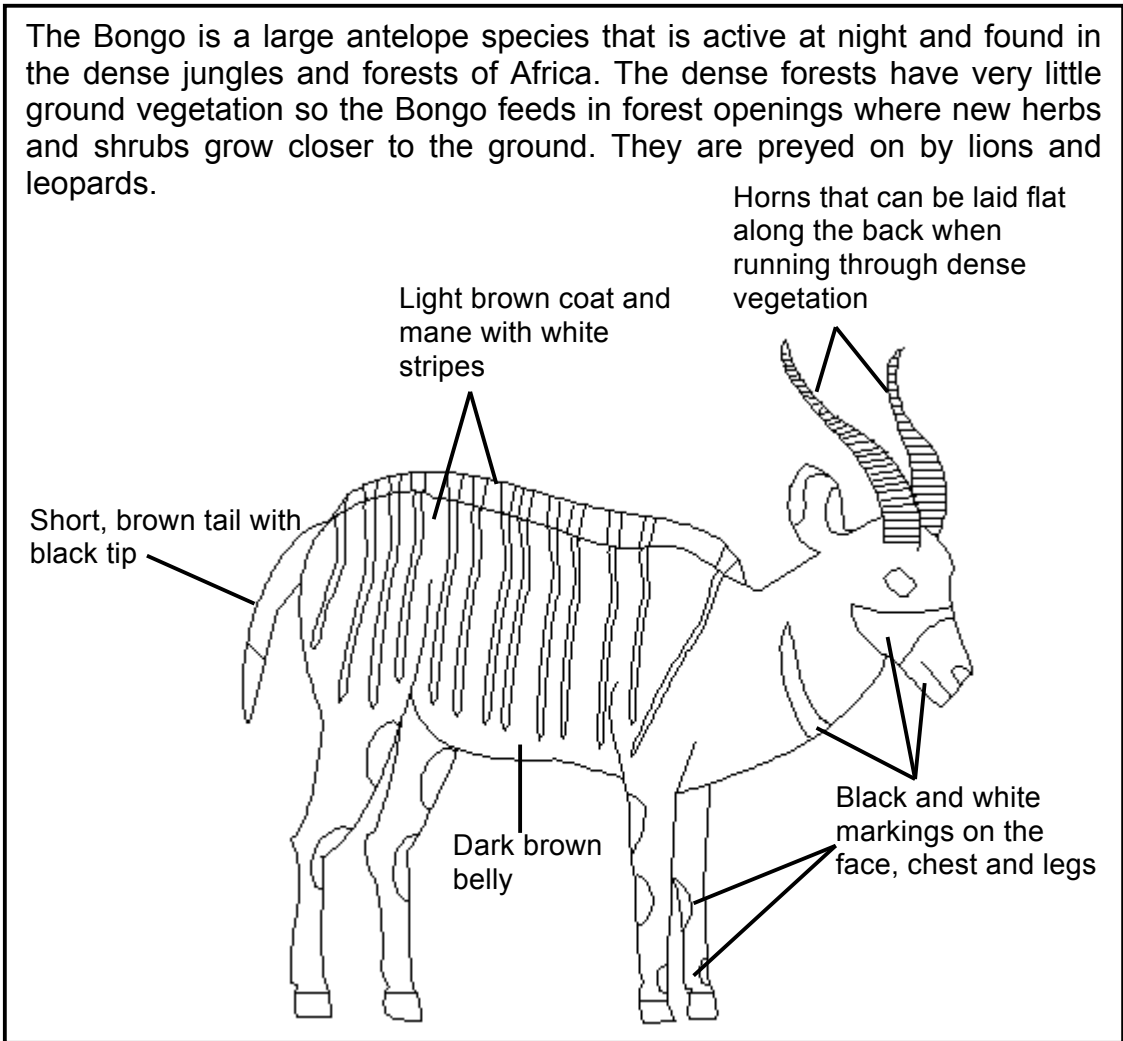
Use a genetic cross to show how it is possible for them to have a child with blood group **O**. (6)  
(11)

2.3 The diagram below shows crossing over during meiosis.



- 2.3.1 Name the phase of meiosis during which the process represented above takes place. (1)
- 2.3.2 Describe the process of *crossing over*. (3)
- 2.3.3 Explain the importance of crossing over. (2)
- 2.3.4 Draw a diagram, giving the position of the alleles, to show the structure of chromatid Y after crossing over. (2)
- (8)**

2.4 The extract and the diagram below provide information about a type of antelope called a Bongo.



2.4.1 State TWO characteristics that help the Bongo to camouflage themselves in the dense jungle. (2)

2.4.2 Use your knowledge of natural selection and explain how the Bongo's ability to lay its horns along its back could have developed over the years. (5)  
(7)

2.5 The characteristics of organisms can be changed through selective breeding and the genetic engineering process.

2.5.1 State TWO similarities between the *selective breeding process* and the *genetic engineering process*. (2)

2.5.2 Explain TWO reasons why some people may be against the use of genetic engineering. (4)  
(6)  
**[40]**

**QUESTION 3**

3.1 Read the extract below.

The recent Ebola outbreak has international medical organisations on high alert. The Ebola virus is deadly because it causes uncontrolled bleeding. The virus is only spread through direct contact with body fluids. There is, however, concern as to whether the Ebola virus could mutate, thereby enabling it to be transmitted through the air. If this happens, the virus would spread more easily.

This virus contains RNA only and when RNA is copied, many more mistakes are made than when DNA is copied. The Ebola virus, therefore, displays high mutation rates that generate lots of genetic variation.

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

3.1.1 State why viruses that contain only RNA show more genetic variation than viruses containing DNA. (2)

3.1.2 Use ONE example from the extract above to explain how mutations could increase the survival rate of the virus. (2)  
**(4)**

3.2 The questions below are based on nucleic acids.

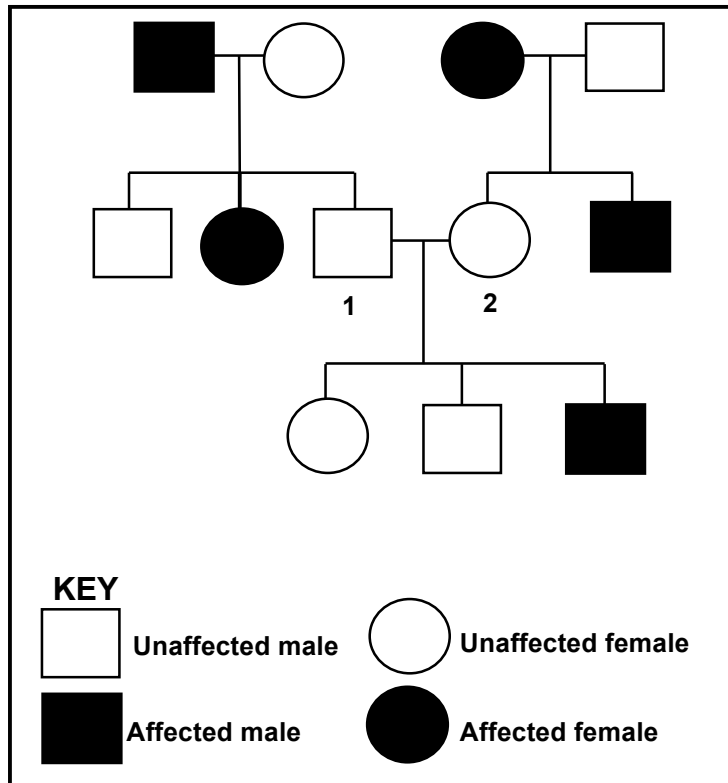
3.2.1 Tabulate THREE structural differences between DNA and RNA. (7)

3.2.2 State TWO uses of DNA profiling. (2)

3.2.3 Give TWO views against the use of DNA profiling. (2)  
**(11)**

3.3 A lack of immunity to infections (agammaglobulinemia) is a sex-linked recessive genetic disorder in humans. The dominant allele is represented by  $X^A$  and the recessive allele is represented by  $X^a$ .

An individual with the disorder is described as affected and an individual without it is described as unaffected. The pedigree diagram below illustrates inheritance of this disorder.



3.3.1 Name the genotypes of individuals:

(a) 1 (2)

(b) 2 (2)

3.3.2 What percentage of the males in this pedigree diagram is affected? Show ALL working. (2)

3.3.3 Explain why any son of an affected female will always have this disorder. (3)

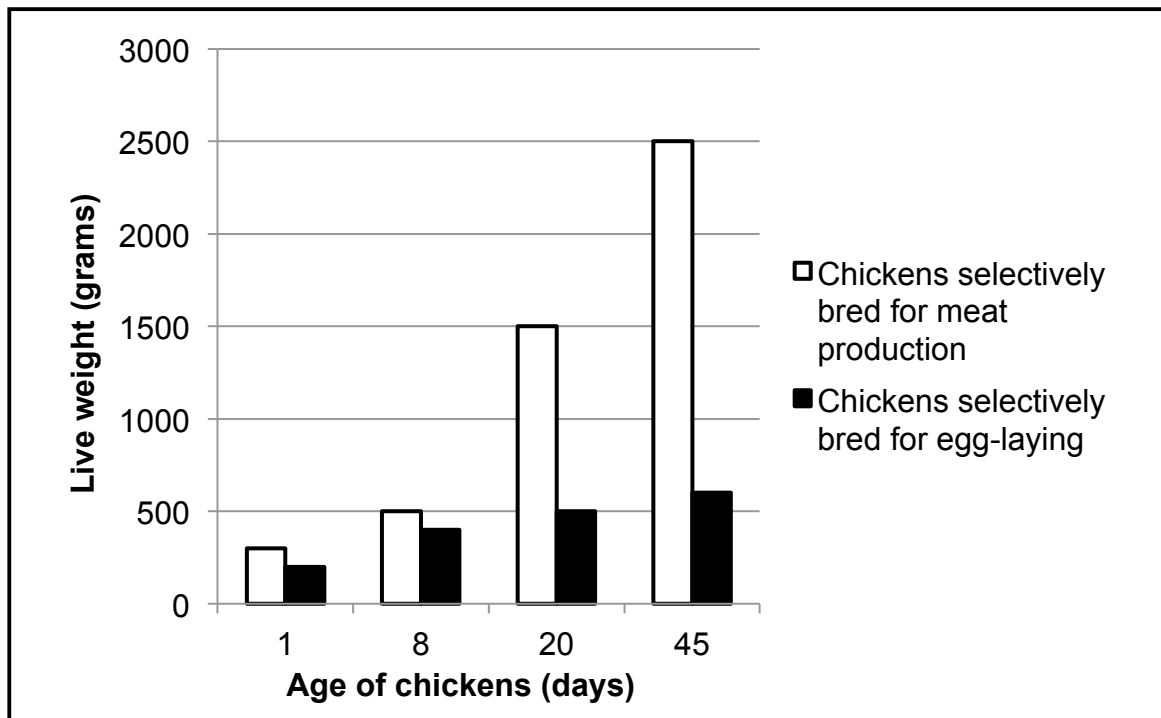
(9)

3.4 An investigation was done by Grade 12 learners to determine which chickens grow faster: chickens that are selectively bred for laying eggs or chickens that are selectively bred for meat production.

The following steps were carried out:

1. The learners bought 30 one-day-old chickens from a commercial supplier. Fifteen of the chickens had been selectively bred for laying eggs and 15 of the chickens had been selectively bred for meat production.
2. All the chickens were kept under the same environmental conditions. This included being fed the same chicken feed, made mostly from cereal grains and protein sources.
3. The chickens were weighed regularly for a period of 45 days.

The results of the investigation are shown in the graph below.



[Adapted from [www.chicken.org.au](http://www.chicken.org.au)]

- 3.4.1 Formulate a hypothesis for this investigation. (2)
- 3.4.2 State the independent variable in this investigation. (1)
- 3.4.3 Calculate the percentage weight increase of the chickens that were selectively bred for meat between day 8 and day 45. Show ALL working. (2)
- 3.4.4 State ONE advantage of repeating the investigation with 100 chickens. (2)

- 3.4.5 State THREE factors that the learners should keep constant in this investigation. (3)
- 3.4.6 Write a suitable conclusion for the investigation based on the results in the graph. (2)
- 3.4.7 State TWO benefits of the selective breeding of chickens, other than for increasing meat production. (2)
- 3.4.8 Explain ONE reason why selective breeding of chickens for better meat production may not be an advantage for the chickens if they were to live in the wild. (2)
- (16)**  
**[40]**
- TOTAL SECTION B: 80**

**SECTION C****QUESTION 4**

Describe the process of protein synthesis and the way in which this process would be affected by a gene mutation.

Content: (17)  
Synthesis: (3)  
**(20)**

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

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