



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

LIFE SCIENCES P1

NOVEMBER 2015

MARKS: 150

TIME: 2½ hours

This question paper consists of 17 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, 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 Which ONE of the following processes is responsible for the production of male gametes?
A Spermatogenesis
B Oogenesis
C Ejaculation
D Ovulation
- 1.1.2 The part of the central nervous system that protects the human body from serious injuries when a person steps barefoot on a thorn is the ...
A cerebellum.
B medulla oblongata.
C spinal cord.
D cerebrum.
- 1.1.3 When a person runs a race, sweating helps to ...
A regulate the amount of salts in the body.
B control the amount of glucose in the body.
C cool the body through evaporation.
D regulate the amount of water in the body.
- 1.1.4 Which ONE of the following is the correct sequence in which impulses are transmitted in a reflex action?
A Receptor → sensory neuron → interneuron → motor neuron → effector
B Receptor → motor neuron → sensory neuron → interneuron → effector
C Receptor → motor neuron → interneuron → sensory neuron → effector
D Receptor → interneuron → sensory neuron → motor neuron → effector
- 1.1.5 Which ONE of the following is a function of adrenalin?
A Lowering blood pressure
B Promoting the conversion of glucose to glycogen
C Increasing skeletal muscle tone
D Causing the blood vessels of the skin to dilate



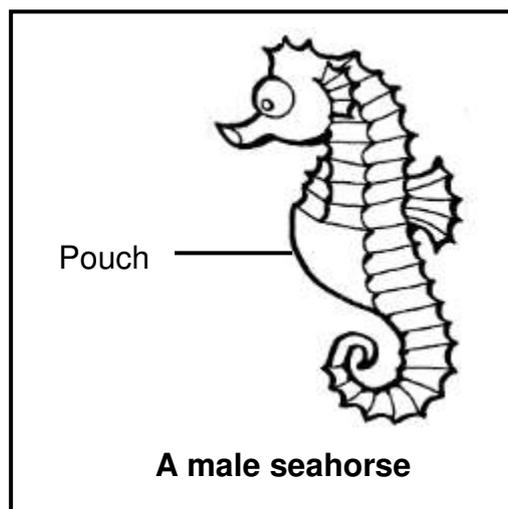
1.1.6 The following structures are part of the male reproductive system:

- (i) Scrotum
- (ii) Prostate gland
- (iii) Seminal vesicles
- (iv) Penis
- (v) Testes

Which ONE of the following combinations of structures produces semen?

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

1.1.7 In seahorses the female deposits the eggs into a pouch in the male's body. The male then secretes sperm into the pouch. Fertilisation takes place in the pouch. The fertilised eggs develop in the pouch.



What type of fertilisation and reproductive strategy does this represent?

- A External fertilisation and vivipary
- B Internal fertilisation and vivipary
- C External fertilisation and ovipary
- D Internal fertilisation and ovipary

QUESTIONS 1.1.8 AND 1.1.9 REFER TO THE INVESTIGATION BELOW.

An investigation was conducted to determine the effect of alcohol on reaction time.

The procedure was as follows:

- Fifty adult volunteers were used.
- Their reaction times were measured at the beginning of the investigation.
- They were each given alcohol to drink.
- Their reaction times were measured again after 30 minutes.

1.1.8 What is the independent variable in the investigation above?

- A Number of volunteers
- B Time after drinking alcohol
- C Reaction time
- D Alcohol in the body

1.1.9 The following factors were considered during the investigation:

- (i) Age of the volunteers
- (ii) Number of volunteers
- (iii) Intake of alcohol
- (iv) Tool used to measure reaction time

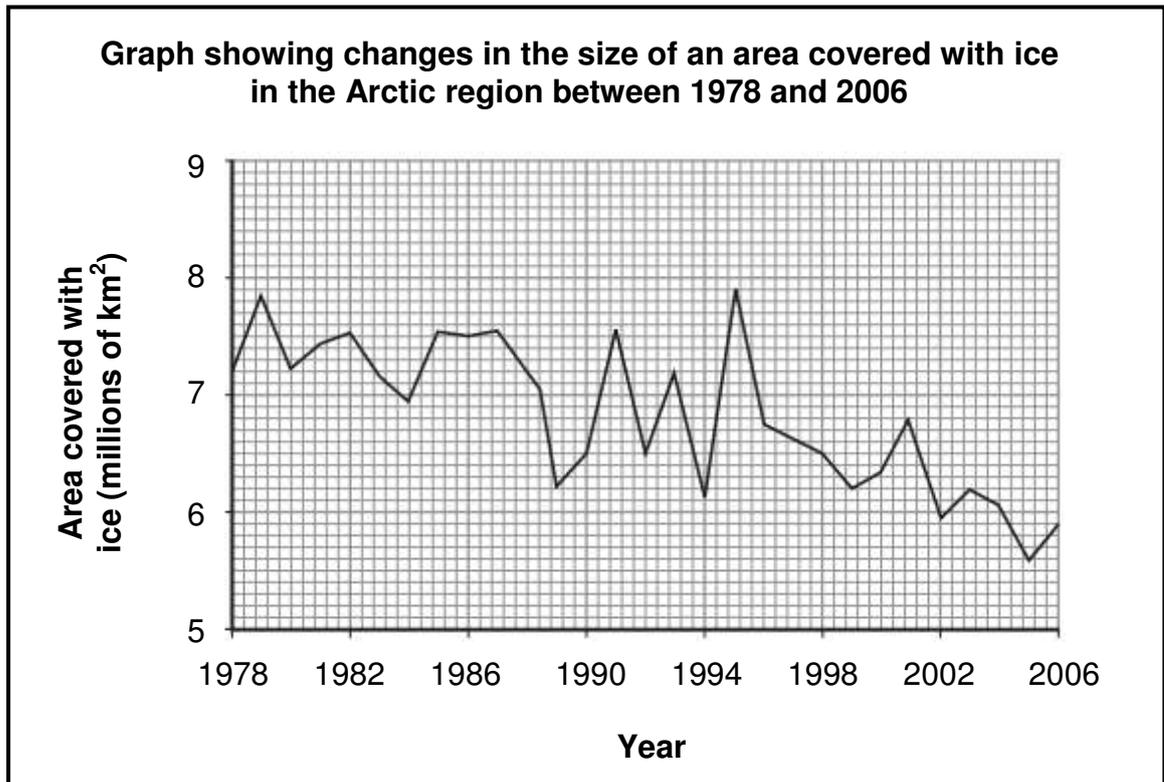
Which ONE of the following combinations of factors will affect the validity of the investigation?

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



- 1.1.10 Rising temperatures on Earth, as a result of the enhanced greenhouse effect, have led to the melting of ice in glaciers.

The graph below shows the results of an investigation that measured changes in the size of an area covered with ice in the Arctic region between 1978 and 2006.



[Adapted from nsidc.org]

The difference between the size of the area covered with ice in 1978 and the size of the area covered with ice in 1998 is ... million km².

- A 1,3
- B 7,2
- C 0,7
- D 5,9

(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 1.2.7) in the ANSWER BOOK.

- 1.2.1 The part of the brain that controls the heart rate
- 1.2.2 The maintenance of a constant internal environment in the body within certain limits
- 1.2.3 The plant growth hormone that promotes seed dormancy
- 1.2.4 A collective name for the membranes that protect the brain
- 1.2.5 A hormone that regulates the salt concentration in human blood
- 1.2.6 A layer in the atmosphere that is damaged by chlorofluorocarbons (CFCs)
- 1.2.7 A hormone that stimulates the maturation of sperm (7 x 1) **(7)**

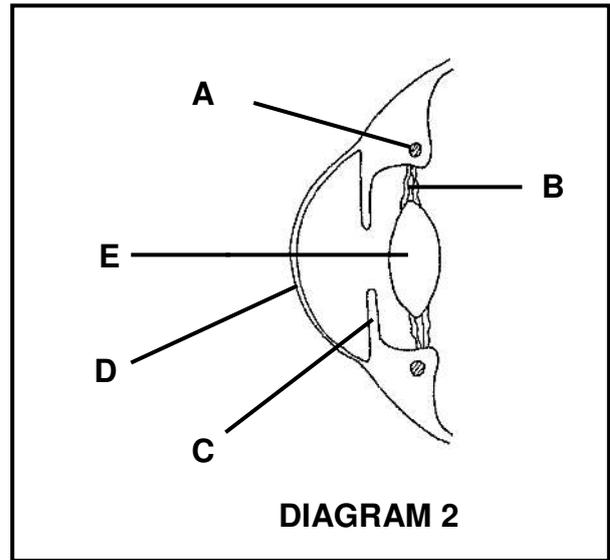
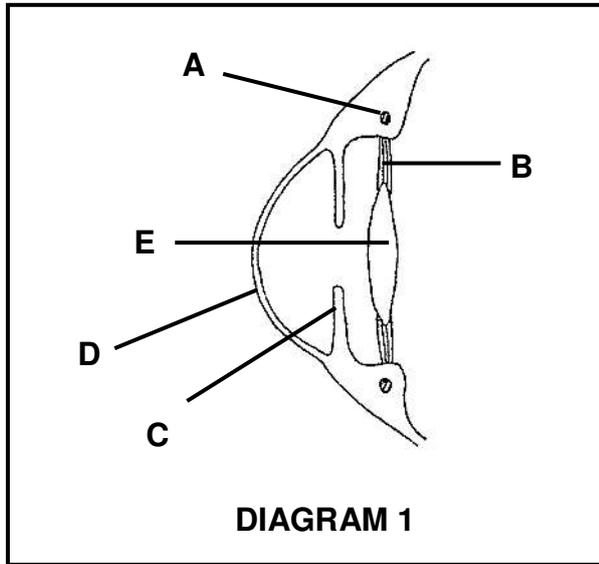
1.3 Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.5) in the ANSWER BOOK.

| COLUMN I | | COLUMN II |
|----------|---|--|
| 1.3.1 | Requires the production of a large number of gametes to ensure survival of the species | A: External fertilisation B: Internal fertilisation |
| 1.3.2 | A type of development in birds where the young are incapable of moving and feeding themselves | A: Precocial development B: Altricial development |
| 1.3.3 | A plant defence mechanism against pathogens | A: Chemicals B: Thorns |
| 1.3.4 | A gland which produces substances that are transported to target organs by ducts | A: Endocrine gland B: Exocrine gland |
| 1.3.5 | Used by plants to reduce the chances of being fed upon by herbivores | A: Chemicals B: Thorns |

(5 x 2) **(10)**

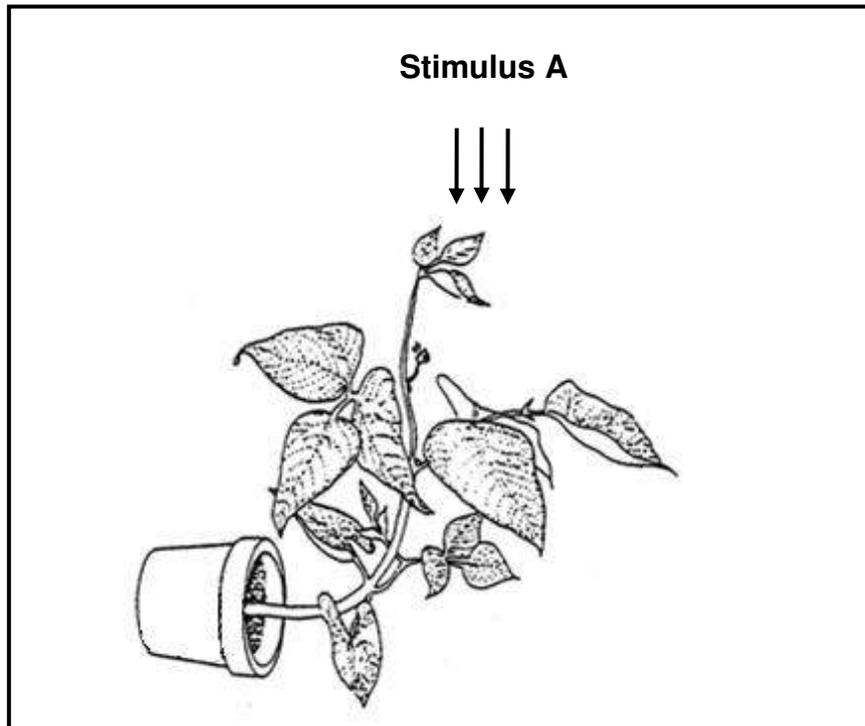


1.4 Each diagram below represents parts of the human eye.



- 1.4.1 Give the LETTER and NAME of the part that:
- (a) Contracts to change the shape of the lens (2)
 - (b) Controls the amount of light that enters the eye (2)
 - (c) Is protected by the conjunctiva (2)
- 1.4.2 Study DIAGRAM 1 and DIAGRAM 2. What process is responsible for the change in the shape of the part E? (1)
- 1.4.3 Which diagram (1 or 2) represents the state of the eye when a person is reading a book? (1)
- (8)**

- 1.5 The diagram below shows the growth movement of a part of a plant towards a stimulus.



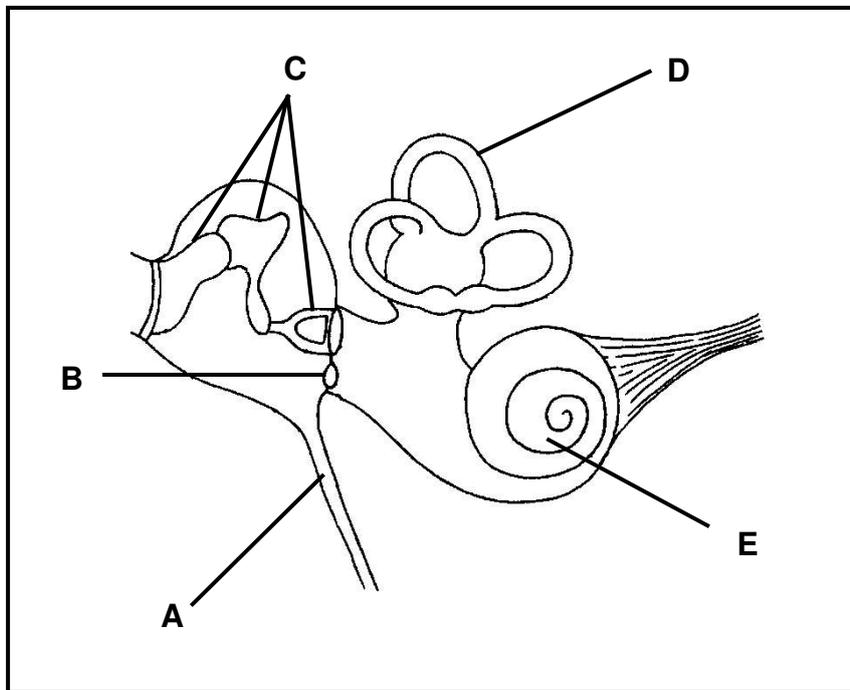
- 1.5.1 What growth movement is represented in the diagram? (1)
- 1.5.2 Identify the stimulus labelled **A**. (1)
- 1.5.3 Name the growth hormone that is responsible for the growth movement named in QUESTION 1.5.1. (1)
- 1.5.4 Will a high concentration of the growth hormone named in QUESTION 1.5.3 **stimulate** or **inhibit** growth in the roots? (1)
- 1.5.5 Name the phenomenon where the buds at the tip of the plant regulate the growth of the lateral branches. (1)

TOTAL SECTION A: 50



SECTION B**QUESTION 2**

2.1 The diagram below represents a part of the human ear.



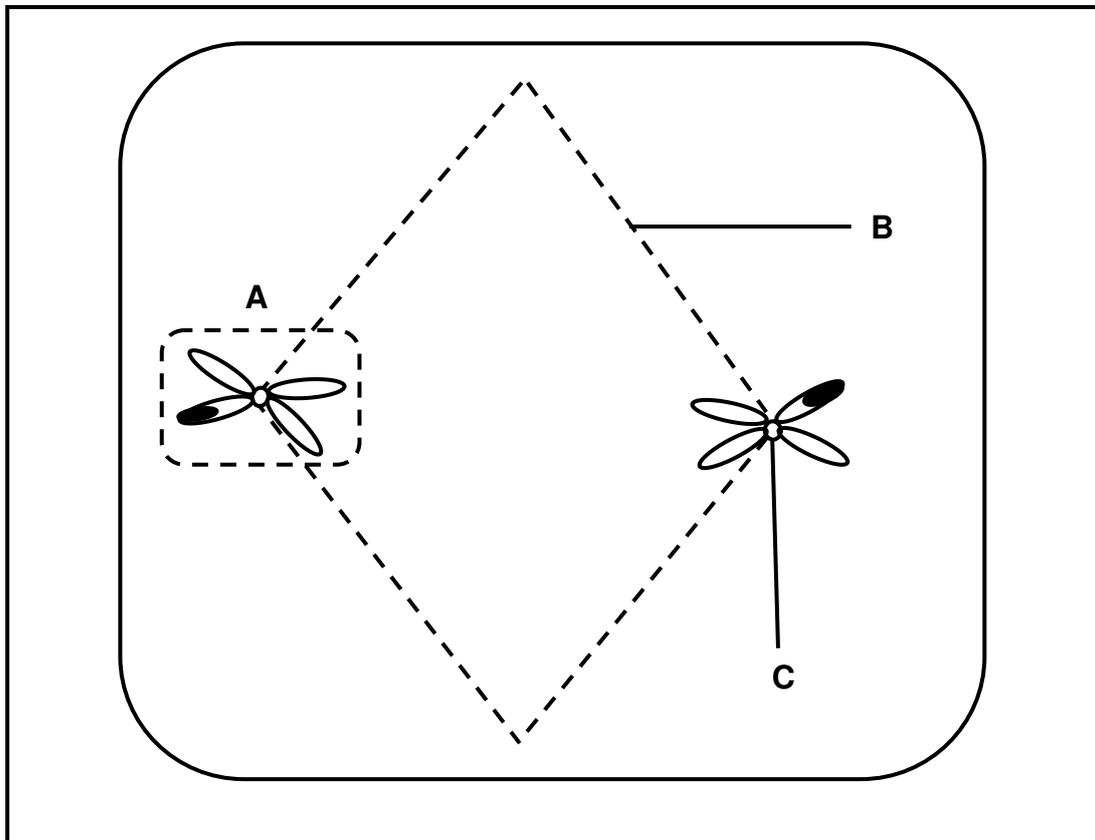
2.1.1 Identify part:

- (a) **A** (1)
- (b) **B** (1)
- (c) **E** (1)

2.1.2 Explain the result if part **A** is blocked. (4)

2.1.3 Describe how part **D**, the semi-circular canals, plays a role in maintaining balance when the body changes speed and direction. (5)
(12)

2.2 The diagram below illustrates a phase in meiosis.



2.2.1 Identify part:

- (a) **A** (1)
- (b) **B** (1)
- (c) **C** (1)

2.2.2 Identify the phase illustrated above. (1)

2.2.3 Give a reason for your answer to QUESTION 2.2.2. (2)

2.2.4 Draw a diagram of the cell above as it would appear during **anaphase I**. (4)
(10)

2.3 An investigation was conducted to determine the diameter of a healthy follicle in a human ovary during the menstrual cycle.

A sample consisting of 50 women aged between 20 and 25, with regular menstrual cycles, was used for this investigation.

The average changes in the follicle diameters of all 50 women during their menstrual cycles were measured and recorded.

2.3.1 Name TWO steps that were considered during the planning of this investigation. (2)

2.3.2 The following results were obtained from the investigation.

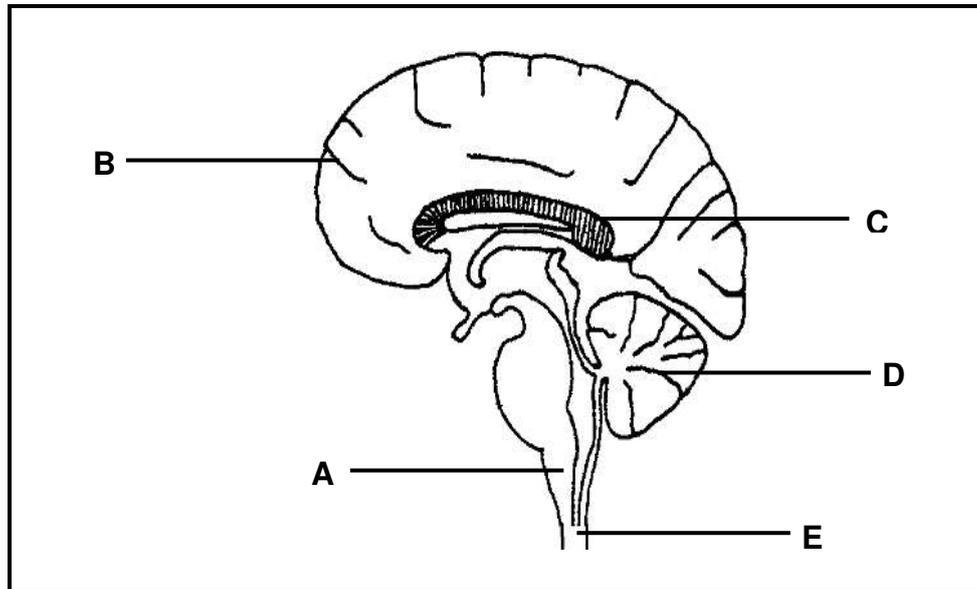
| DAYS WHEN FOLLICLES WERE MEASURED | AVERAGE FOLLICLE DIAMETERS OF THE 50 WOMEN (mm) |
|--|--|
| 5 | 6,9 |
| 10 | 13,3 |
| 13 | 18,8 |
| 14 | 22,0 |
| 20 | 3,4 |
| 25 | 2,6 |

[Adapted from *Journal of Reproduction and Fertilisation*, 1983]

Use the results and explain:

- (a) The changes in the follicle diameters from day 14 to day 25 (3)
- (b) How the results would probably differ if all 50 women used contraceptive pills that contained a high level of progesterone (3)
- (8)

2.4 The diagram below represents the central nervous system in a human.



2.4.1 Identify part:

- (a) **A** (1)
- (b) **C** (1)
- (c) **D** (1)

2.4.2 State THREE functions of part **B**. (3)
(6)

2.5 Describe the structure and the functioning of the autonomic nervous system. (4)
[40]

QUESTION 3

- 3.1 Describe how the human body restores the carbon dioxide concentration in the blood when it rises above normal levels. (6)
- 3.2 An investigation was conducted to compare the glucose concentration in the blood of two people, Mo and Thabiso, before and after ingesting glucose.

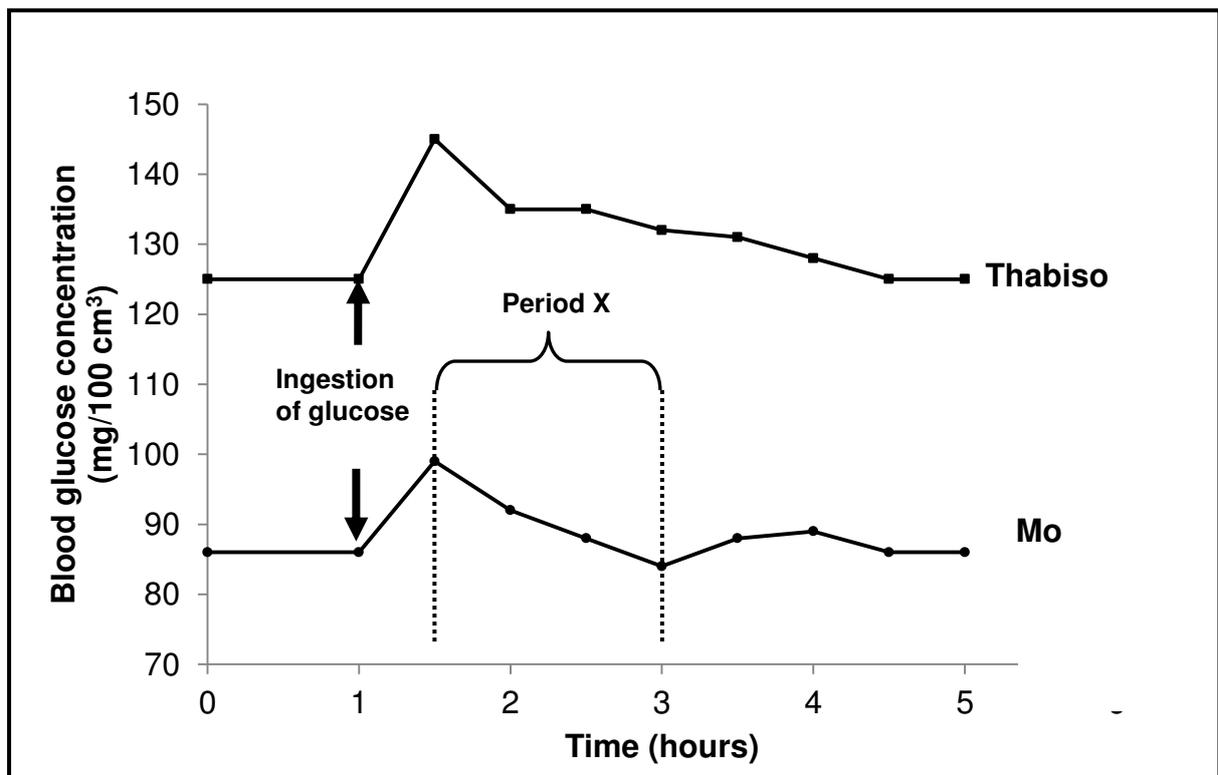
The following procedure was followed:

- The glucose concentration in their blood was measured at the start of the investigation and again 1 hour into the investigation.
- One hour into the investigation each of them was given 50 ml of a glucose solution to drink.
- For the next 4 hours after ingesting the glucose solution the glucose concentration in their blood was measured every 30 minutes.

The results are shown in the graph below.

The **arrows** indicate when they drank the glucose solution.

NOTE: The normal glucose concentration in blood is between 80 and 120 mg/100 cm³.



- 3.2.1 Provide a suitable title for this graph. (2)
- 3.2.2 By how much did Thabiso's blood glucose concentration level increase (in mg/100 cm³) after drinking the glucose solution? Show ALL working. (2)



- 3.2.3 How long did it take Mo's blood glucose concentration level to return to its original level after ingesting the glucose solution? (1)
- 3.2.4 (a) Who (Thabiso or Mo) has diabetes mellitus? (1)
- (b) Give ONE observable reason for your answer to QUESTION 3.2.4(a). (1)
- 3.2.5 Explain the changes in Mo's glucose level during period X. (4)
- (11)**

3.3 Read the extract below.

HUNTING WILDLIFE FOR FOOD

An organisation, Trade Records Analysis of Fauna and Flora in Commerce (TRAFFIC), did an investigation to find out about the extent of the illegal killing of wildlife for use as bush-meat (meat from wildlife) and the influence of this on the environment.

The organisation reported that the illegal killing of wildlife, both for trade and consumption, had been on the increase in many African countries during the past two years. It also reported that some species, such as impala, were preferred to other species of wildlife.

One of the organisation's recommendations was that the hunting of wildlife should be legalised. This would enable governments in these countries to control the number of animals being hunted and also to restrict the age of animals that may be hunted. It also recommended that only those animals that were very old and weak in a population should be hunted.

[Adapted from an article 'Wildlife Under Siege', *Endangered Wildlife*, 2000]

- 3.3.1 What is the illegal hunting and killing of animals called? (1)
- 3.3.2 State ONE way in which humans destroy wildlife habitats. (1)
- 3.3.3 Give TWO reasons for the increase in the illegal killing of wildlife. (2)
- 3.3.4 Explain how the increase in the killing of wildlife will influence the environment. (3)
- 3.3.5 Explain why the organisation recommended that only very old and weak animals in a population should be killed if hunting is legalised. (3)
- (10)**



3.4 Read the extract below.

FOOD SECURITY IN SOUTH AFRICA

One of the challenges in South Africa is access to food by the poor. In 2009 Statistics SA conducted a survey to determine the percentage of households in each province that had access to food.

The results are shown in the table below:

| PROVINCE | HOUSEHOLDS THAT HAVE ACCESS TO FOOD (%) |
|---------------|---|
| Western Cape | 85 |
| Eastern Cape | 79 |
| Mpumalanga | 79 |
| Free State | 67 |
| Northern Cape | 75 |
| North West | 79 |
| KwaZulu-Natal | 77 |
| Limpopo | 88 |
| Gauteng | 82 |

South Africa seems to have adequate food access in urban areas, but the same cannot be said of households in rural areas. In rural areas prices of staple foods (e.g. maize and rice) are usually higher than in urban areas.

Increasing agriculture is the key to food security and poverty alleviation. The majority of people living in rural areas have access to land, but more still needs to be done to make household farming (growing crops for family use only) in these areas more efficient.

[Adapted from *Food Security*, Department of Agriculture, Forestry and Fisheries, March 2011]

- 3.4.1 What is meant by *food security*? (2)
- 3.4.2 Suggest ONE reason why food prices in rural areas are usually higher than food prices in urban areas. (1)
- 3.4.3 State TWO ways in which household farming could reduce poverty. (2)
- 3.4.4 Suggest TWO ways in which the Department of Agriculture can improve farming in the rural areas. (2)
- 3.4.5 DRAW a bar graph to compare access to food in the following three provinces, namely Limpopo, Northern Cape and Free State. (6)
- (13)**
[40]

TOTAL SECTION B: 80



SECTION C**QUESTION 4**

Explain the structural suitability of the sperm cell for its function and describe its involvement in the formation of a zygote and the development of this zygote until implantation.

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





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**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

LIFE SCIENCES P1

NOVEMBER 2015

MEMORANDUM

MARKS: 150

This memorandum consists of 12 pages.

PRINCIPLES RELATED TO MARKING LIFE SCIENCES

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 a part of it is required**
Read all and credit the relevant part.
4. **If comparisons are asked for but descriptions are given**
Accept if the 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 the sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If sequence and links become correct again, resume credit.
9. **Non-recognised abbreviations**
Accept if first defined in answer. If not defined, do not credit the unrecognised abbreviation but credit the rest of the 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 recognisable, accept the answer, provided it does not mean something else in Life Sciences or if it is out of context.
13. **If common names are given in terminology**
Accept, provided it was accepted at the national memo discussion meeting.
14. **If only the letter is asked for but only the name is given (and vice versa)**
Do not 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 appear(s) 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.
19. **Changes to the memorandum**
No changes must be made to the memoranda without consulting the provincial internal moderator who in turn will consult with the national internal moderator (and the Umalusi moderators where necessary).
20. **Official memoranda**
Only memoranda bearing the signatures of the national internal moderator and the Umalusi moderators and distributed by the national Department of Basic Education via the provinces must be used.

SECTION A**QUESTION 1**

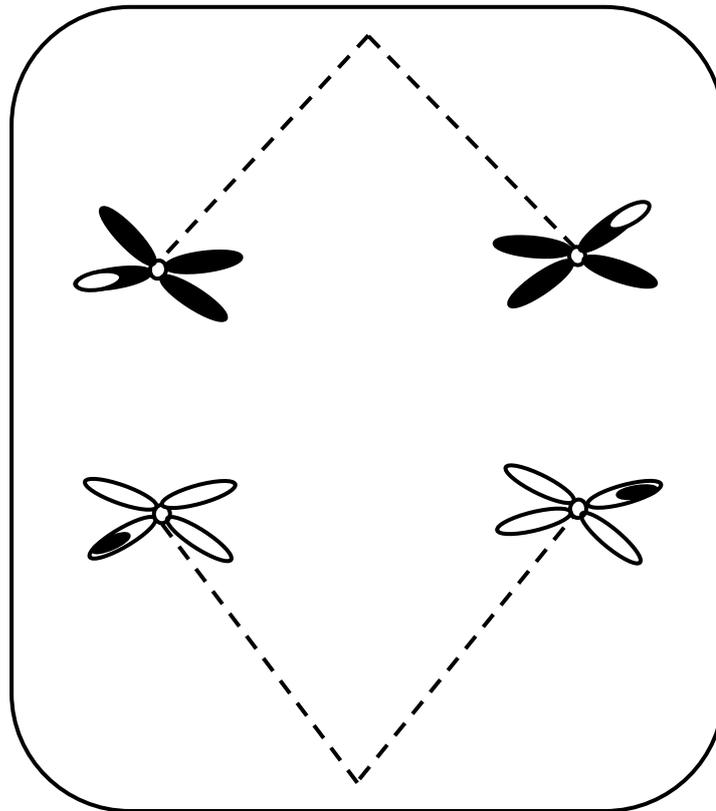
| | | | | |
|-----|--------|----------------------------------|----------|-------------|
| 1.1 | 1.1.1 | A✓✓ | | |
| | 1.1.2 | C✓✓ | | |
| | 1.1.3 | C✓✓ | | |
| | 1.1.4 | A✓✓ | | |
| | 1.1.5 | C✓✓ | | |
| | 1.1.6 | C✓✓ | | |
| | 1.1.7 | C✓✓ | | |
| | 1.1.8 | D✓✓ | | |
| | 1.1.9 | B✓✓ | | |
| | 1.1.10 | C✓✓ | (10 x 2) | (20) |
| 1.2 | 1.2.1 | Medulla oblongata✓ | | |
| | 1.2.2 | Homeostasis✓ | | |
| | 1.2.3 | Abscisic acid✓/ABA | | |
| | 1.2.4 | Meninges✓ | | |
| | 1.2.5 | Aldosterone✓ | | |
| | 1.2.6 | Ozone✓/O ₃ | | |
| | 1.2.7 | Testosterone✓/FSH/LH | | (7) |
| 1.3 | 1.3.1 | Both A and B✓✓ | | |
| | 1.3.2 | B only✓✓ | | |
| | 1.3.3 | A only✓✓ | | |
| | 1.3.4 | B only✓✓ | | |
| | 1.3.5 | Both A and B✓✓ | (5 x 2) | (10) |
| 1.4 | 1.4.1 | (a) A✓ - ciliary muscle✓ | | (2) |
| | | (b) C✓ - iris✓ | | (2) |
| | | (c) D✓ - cornea✓ | | (2) |
| | 1.4.2 | Accommodation✓ | | (1) |
| | 1.4.3 | Diagram 2✓ | | (1) |
| | | | | (8) |
| 1.5 | 1.5.1 | Phototropism✓ | | (1) |
| | 1.5.2 | Light✓/Sunlight/Radiant energy | | (1) |
| | 1.5.3 | Auxins✓/ IAA/ Indole acetic acid | | (1) |
| | 1.5.4 | Inhibit ✓ | | (1) |
| | 1.5.5 | Apical dominance✓ | | (1) |
| | | | | (5) |

TOTAL SECTION A: 50

SECTION B**QUESTION 2**

- 2.1 2.1.1 (a) Eustachian tube✓ (1)
- (b) Round window✓ (1)
- (c) Cochlea✓ (1)
- 2.1.2 - Air will not be taken in✓/released
- to equalise pressure✓
- on both sides of the tympanic membrane✓
- Tympanic membrane/ ossicles may not vibrate freely✓
- This may lead to the tympanic membrane bursting✓ and
- therefore could lead to hearing loss✓/deafness/ pain (Any 4) (4)
- 2.1.3 Changes in the direction and speed of movement:
- Causes the endolymph to move✓ in part D/semi-circular canals
- The cristae✓
- found in the ampulla ✓are stimulated
- and converts the stimulus into an impulse✓
- which is transmitted via the auditory nerve✓/ vestibular nerve
- to the cerebellum✓
- from which impulses are transmitted via motor neurons✓
- to the skeletal muscles✓/effector to restore balance of the body
(Any 5) (5)
- (12)**
- 2.2 2.2.1 (a) Chromosome✓ (1)
- (b) Spindle fibre✓ (1)
- (c) Centromere✓ (1)
- 2.2.2 Metaphase II✓ (1)
- 2.2.3 - Chromosomes lying independently✓/singly
- at the equator✓ (2)

2.2.4

Mark allocation:

- C - Shows 4 chromosomes ✓✓ (not chromatids)
 S - Shows separation ✓ of genetic material
 D - Correct variation shown in the chromosomes ✓ (shading on the chromosomes must be complementary)
 (Use the letters for marking process)

(4)
(10)

- 2.3 2.3.1
- Seek permission✓/ethical clearance
 - Deciding on the sample size✓
 - Deciding on the equipment for measuring✓
 - Deciding on the age-group of the participants✓
 - Deciding on using women with regular menstrual cycles✓
 - Deciding on how to record the results✓
 - Decide on the duration✓
 - Learning how to use the equipment✓ (Any 2) (2)
- (MARK FIRST TWO ONLY)**
- 2.3.2 (a)
- The follicles decreased in size✓
 - as ovulation had taken place✓
 - The resulting corpus luteum became smaller✓
 - because fertilisation did not take place✓ (Any 3) (3)
- (b)
- The production of FSH✓
 - will be inhibited✓
 - which will stop/inhibit the development/growth of a follicle✓
 - therefore the follicle size will remain the same✓ (Any 3) (3)
- (8)**
- 2.4 2.4.1 (a) Medulla oblongata✓ (1)
- (b) Corpus callosum✓ (1)
- (c) Cerebellum✓ (1)
- 2.4.2
- Controls all voluntary activities✓/example
 - It contains centres that receives and interprets all the sensations✓/example
 - It is the seat of higher mental functions✓/example
 - Influences emotional behaviour/ example (Any 3) (3)
- (MARK FIRST THREE ONLY)** **(6)**
- 2.5
- Every organ and gland is controlled by two sets of nerves✓/double innervations
 - that act antagonistically✓
 - to control involuntary events✓/brings about homeostasis
 - Sympathetic✓ nerves
 - generally stimulates a response✓/example
 - Parasympathetic✓ nerves
 - generally inhibits a response✓/example (Any 4) **(4)**
- [40]**

QUESTION 3

- 3.1
- Receptor cells✓
 - in the carotid artery✓/aorta are stimulated
 - to send impulses to the medulla oblongata✓ in the brain
 - which then **stimulates the heart**✓
 - to beat faster✓
 - and the breathing muscles ✓/example
 - to contract more actively✓
 - This increases the rate/ depth of breathing✓
 - More CO₂ is taken to and exhaled from the lungs✓ returning the CO₂ level in the blood to normal (Any 6) **(6)**
- 3.2
- 3.2.1 Comparison of the blood glucose level of two people✓ over 5 hours✓/before and after ingesting glucose **(2)**
- 3.2.2 (145 – 125)✓
(Accept numbers in range 144 -146 for the first value and 124 -126 for the second value)
- = 20✓ mg/100 cm³ **(2)**
(Accept answer according to the values given by learner)
- 3.2.3 Accept any answer from 1,7 to 1,9✓ hours /102 – 114minutes/ 1h42min – 1h54min **(1)**
- 3.2.4 (a) Thabiso✓ **(1)**
- (b) - His glucose level is higher than the normal range✓
- It takes longer for his glucose level to come down to its original level✓ **(Any 1) (1)**
- (MARK FIRST ONE ONLY)**
- 3.2.5
- When his glucose level is high✓/ 99/98mg/100cm³
 - insulin✓ is secreted into the blood
 - to convert excess glucose into glycogen ✓ in the liver
 - and to stimulate the cells to absorb more glucose✓
 - thus decreasing the blood glucose level✓ **(Any 4) (4)**
- (11)**
- 3.3
- 3.3.1 Poaching✓ **(1)**
- 3.3.2
- Deforestation✓
 - Urbanisation✓
 - Mining ✓
 - Agriculture✓
 - Veld fires✓
 - Building✓
 - Pollution✓
 - Introduction of alien species✓ **(Any 1) (1)**
- (MARK FIRST ONE ONLY)**

- 3.3.3
- Increasing human population✓
 - Increasing unemployment✓/poverty
 - Increased prices of bush-meat✓/greed
 - Increased demand✓
 - Poor protection of wildlife✓
- (Any 2) (2)

(MARK FIRST TWO ONLY)

- 3.3.4
- Disturbs the ecosystem✓
 - because food chains are affected✓
 - leading to the extinction of some species✓ in the ecosystem
 - and will eventually lead to loss of biodiversity✓
- (Any 3) (3)

- 3.3.5
- Very old animals have passed the reproductive stage in their lives✓/old animals are at the end of lifespan
 - therefore may not significantly influence the size of the population✓
 - Weak animals have a short lifespan✓
 - and will not contribute to the survival of the population✓
 - Killing old and weak animals may prevent a population from exceeding carrying capacity✓
 - Genes causing weakness will be removed from the gene pool✓
- (Any 3) (3)
(10)

- 3.4 3.4.1
- Food security refers to the access✓
 - of adequate✓/safe/nutritious food
 - to all people at all times✓
- (Any 2) (2)

- 3.4.2
- Price is added to cover the cost of transportation✓ over long distances
 - No competition✓ between dealers in rural areas
 - Decrease demand✓ for goods in rural areas
- (Any 1) (1)

(MARK FIRST ONE ONLY)

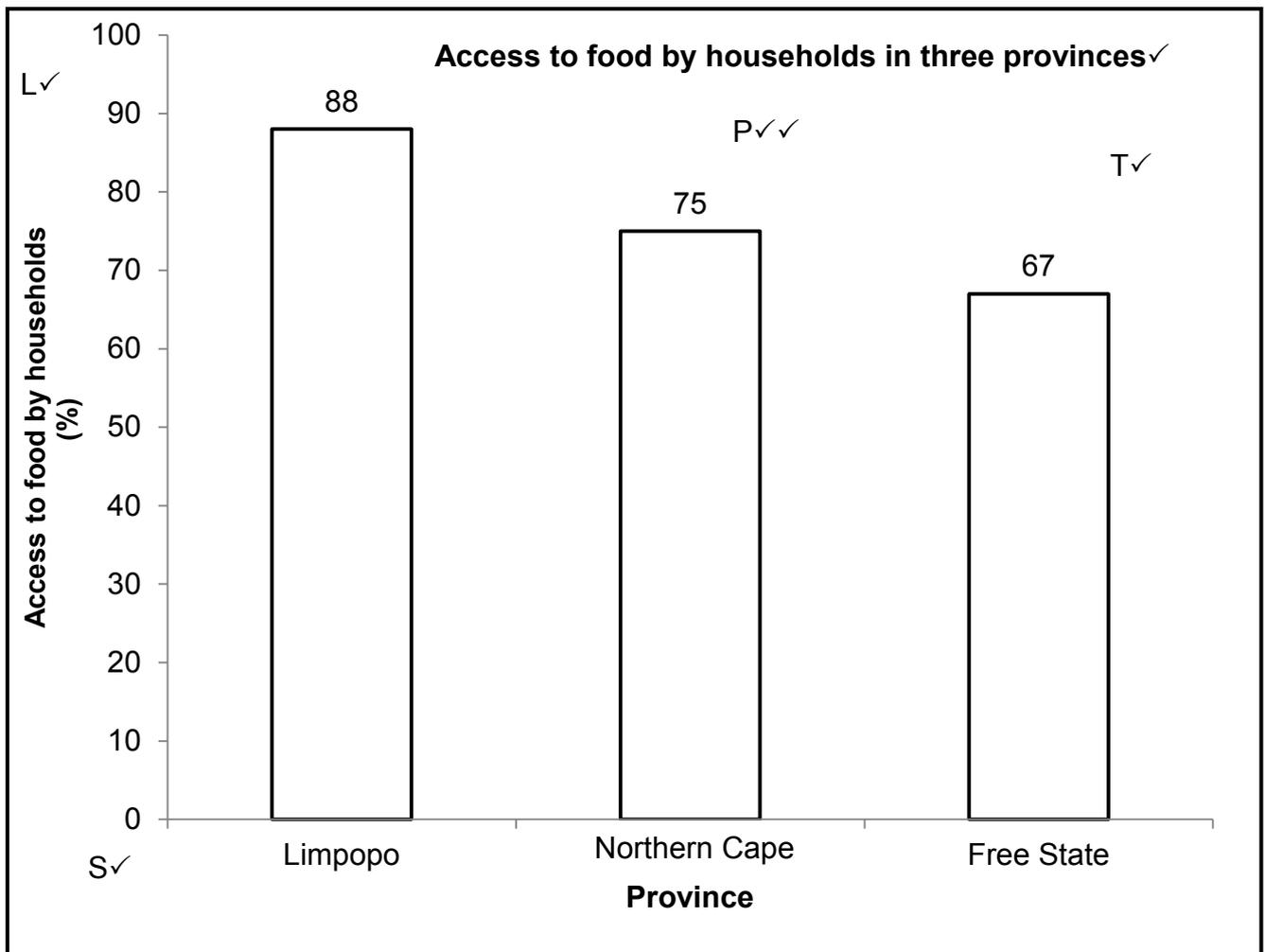
- 3.4.3
- Decreased need to buy food✓
 - Selling of excess produce to earn some money✓
- (2)

(MARK FIRST TWO ONLY)

- 3.4.4
- Making people aware of the benefits of farming✓
 - Providing resources✓/example
 - Developing skills for farming✓
 - Providing incentives✓ to encourage farming
- (Any 2) (2)

(MARK FIRST TWO ONLY)

3.4.5



Mark allocation of the graph

| Criteria | Mark Allocation |
|---|---|
| Bar graph drawn (T) | 1 |
| Title of graph | 1 |
| Correct scale for X-axis (equal width and spacing of the bars) and Y-axis (S) | 1 |
| Correct label and unit for X-axis and Y-axis (L) | 1 |
| Plotting of the bars (P) | 0: No bars plotted correctly 1: 1 to 2 bars plotted correctly 2: All 3 bars plotted correctly |

NOTE:

If a line graph is drawn – marks will be **awarded** for the 'title and label for X and Y axes' only
 If a histogram is drawn – marks will be **lost** for the 'type of graph and correct scale' only

(6)
(13)
[40]

TOTAL SECTION B: 80

Please turn over

SECTION C**QUESTION 4****Structural suitability of the sperm cell for internal fertilisation**

- The front of the head of the sperm cell contains an acrosome✓/vesicle which carries enzymes to dissolve a path into the ovum✓
- Nucleus of the sperm✓ carries genetic material of the male✓/ haploid number of chromosomes
- The middle piece contains mitochondria✓ which release energy✓ so that sperms could swim
- The presence of a long tail✓ enables sperm cells to swim✓ towards the ovum
- The contents of the sperm cell such as the cytoplasm is reduced✓/condensed making the sperm light for efficient movement✓ (Any 3 x 2) (6)

Fertilisation

- In the Fallopian tubes✓
- one sperm cell makes contact with the ovum's membrane✓
- The nucleus of the sperm enters the ovum✓
- Then the ovum membrane becomes impenetrable✓to other sperms
- The nucleus of the sperm fuses✓ } OR sperm fuses with an ovum✓
- with the nucleus of the ovum✓
- to form a diploid✓ zygote
- This is called fertilisation✓ (Any 5) (5)

Events after fertilisation until implantation

- The zygote divides by mitosis✓ many times
 - to form an embryo✓
 - It first consists of a ball of cells✓
 - called the morula✓
 - which then develops into a hollow ball of cells✓
 - called the blastula✓/blastocyst
 - It embeds itself into the uterus lining✓/endometrium
 - using chorionic villi✓ (Any 6) (6)
- Content: (17)
Synthesis: (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

| Relevance | Logical sequence | Comprehensive |
|---|---|--|
| All information provided is relevant to the question | Ideas arranged in a logical/ cause-effect sequence | Answered all aspects required by the essay in sufficient detail |
| Only information regarding: - The structural suitability of the sperm cell - Events during fertilisation - Events after fertilisation until implantation No irrelevant information. | All structures are related to the respective functions of the sperm cell. The sequence of events in fertilisation and post fertilisation until implantation is in the correct order. | At least the following points should be included: - The structural suitability of the sperm cell (4/6) - Events during fertilisation (3/5) - Events after fertilisation until implantation (4/6) |
| 1 mark | 1 mark | 1 mark |

TOTAL SECTION C: 20
GRAND TOTAL: 150



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.

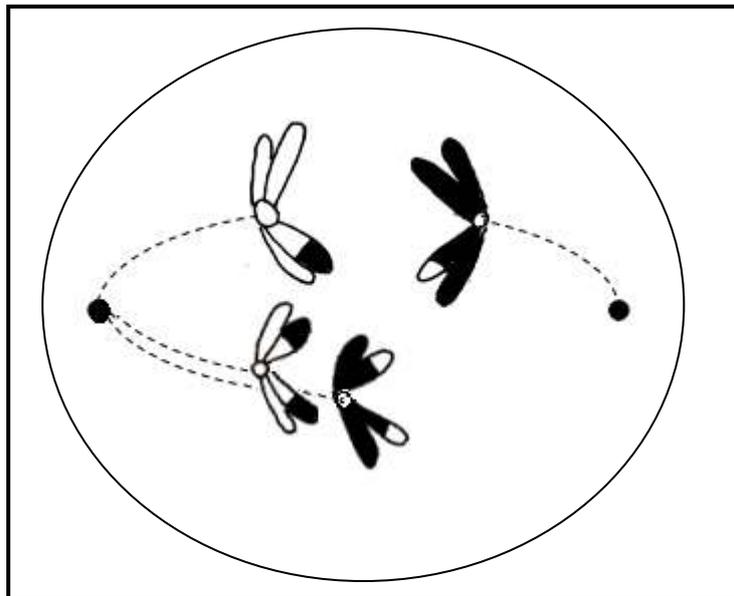
SECTION A**QUESTION 1**

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.

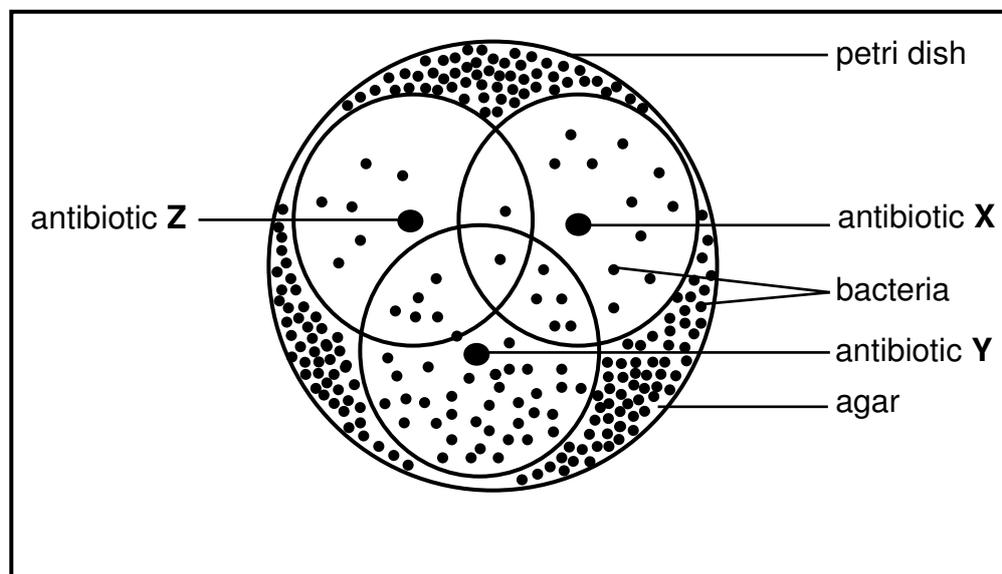
1.1.3 The DNA of different species only differs in the ...

- 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 P₁ 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)

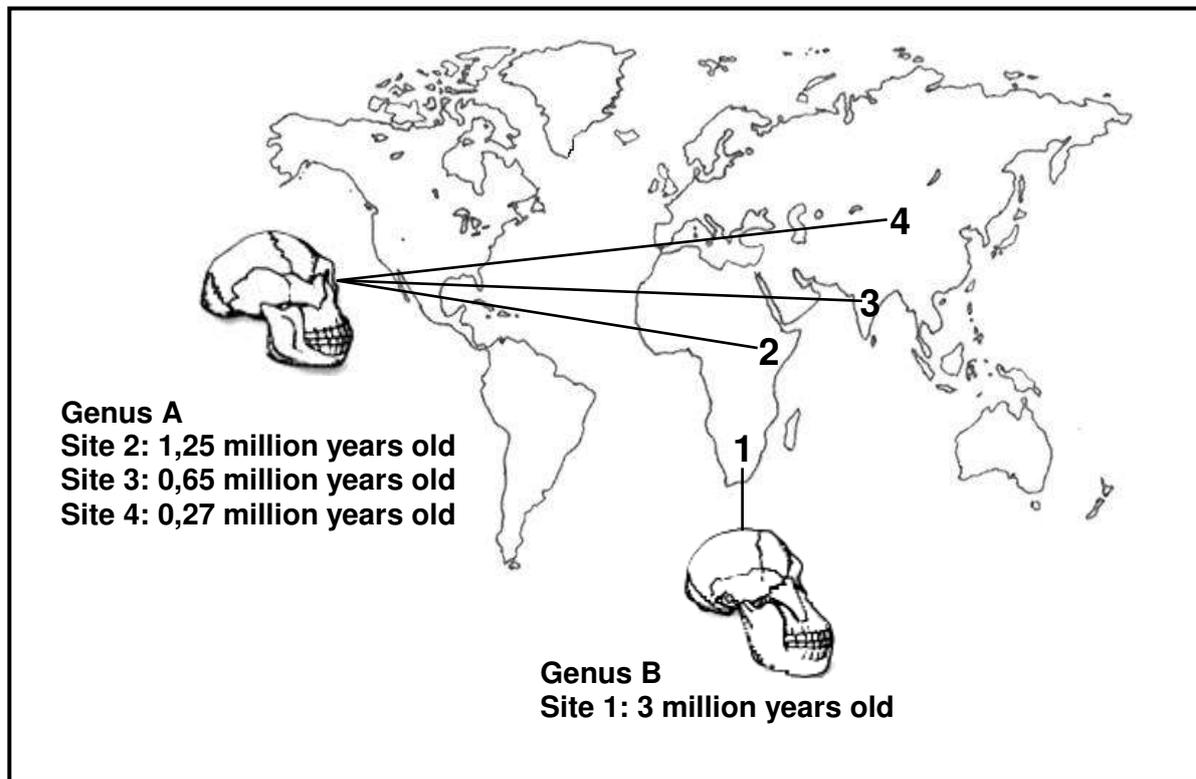
1.3 Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question number (1.3.1 to 1.3.4) in the ANSWER BOOK.

| 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.



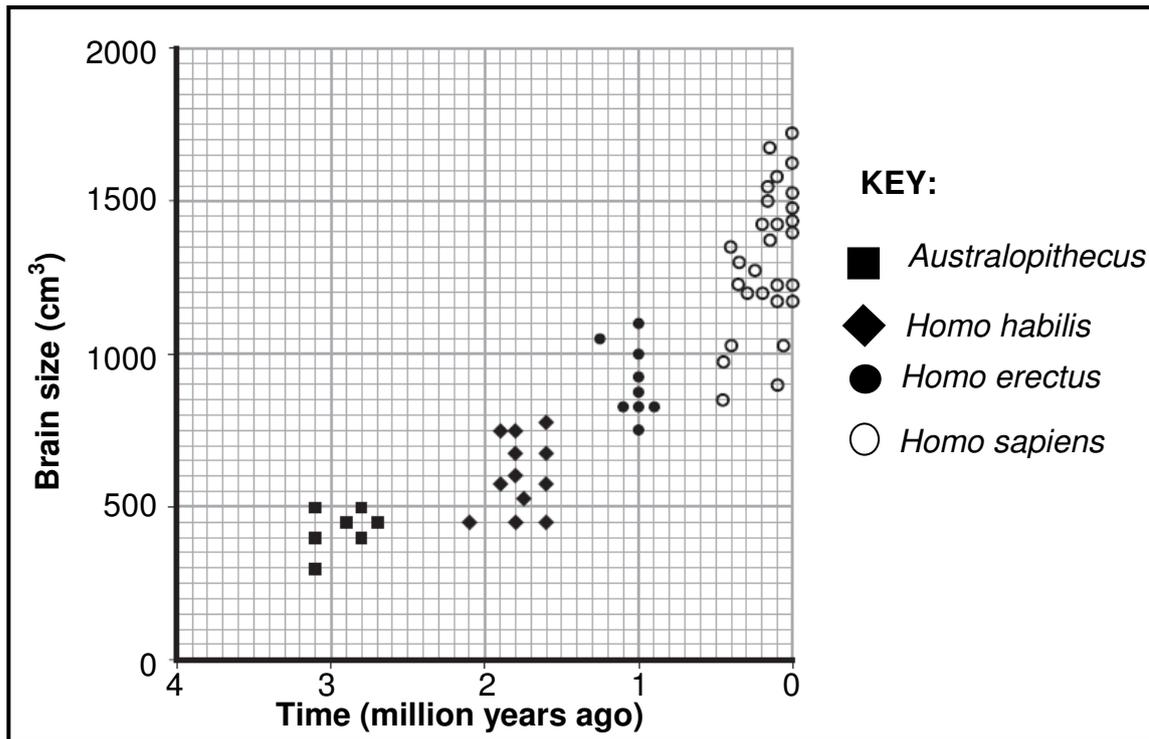
[Adapted from www.biologyreference.com]

- 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 cm³) 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)

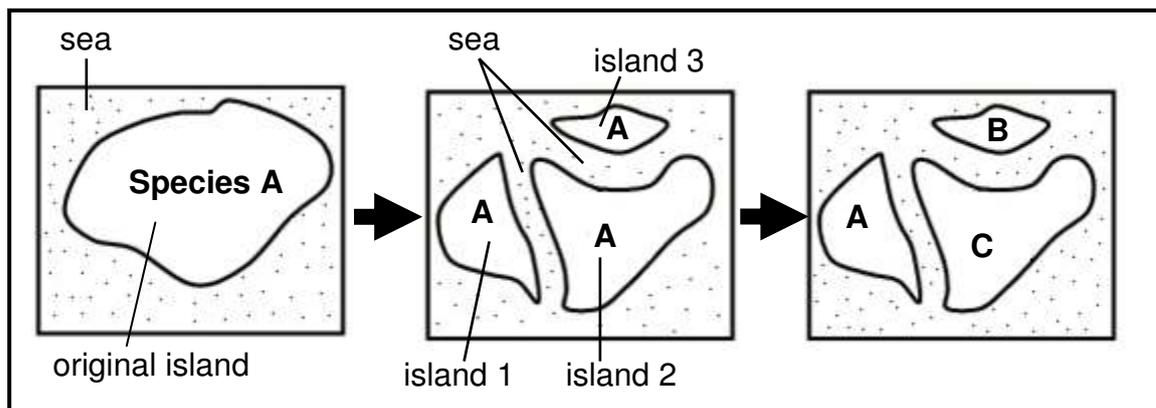
TOTAL SECTION A: 50

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)

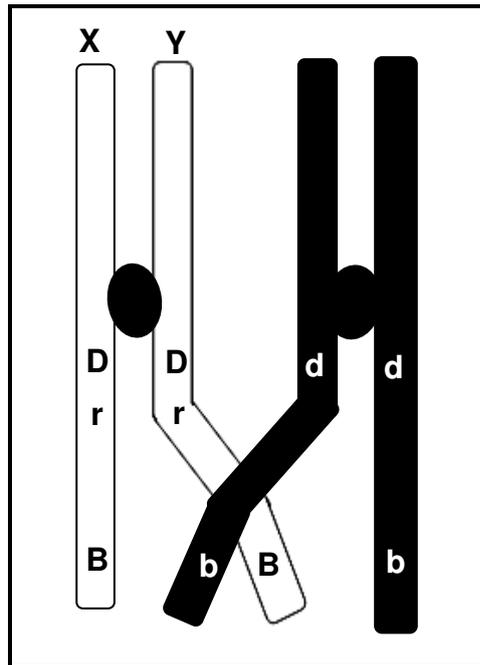
2.2 The father of a child can be determined by analysing blood groups.

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**.

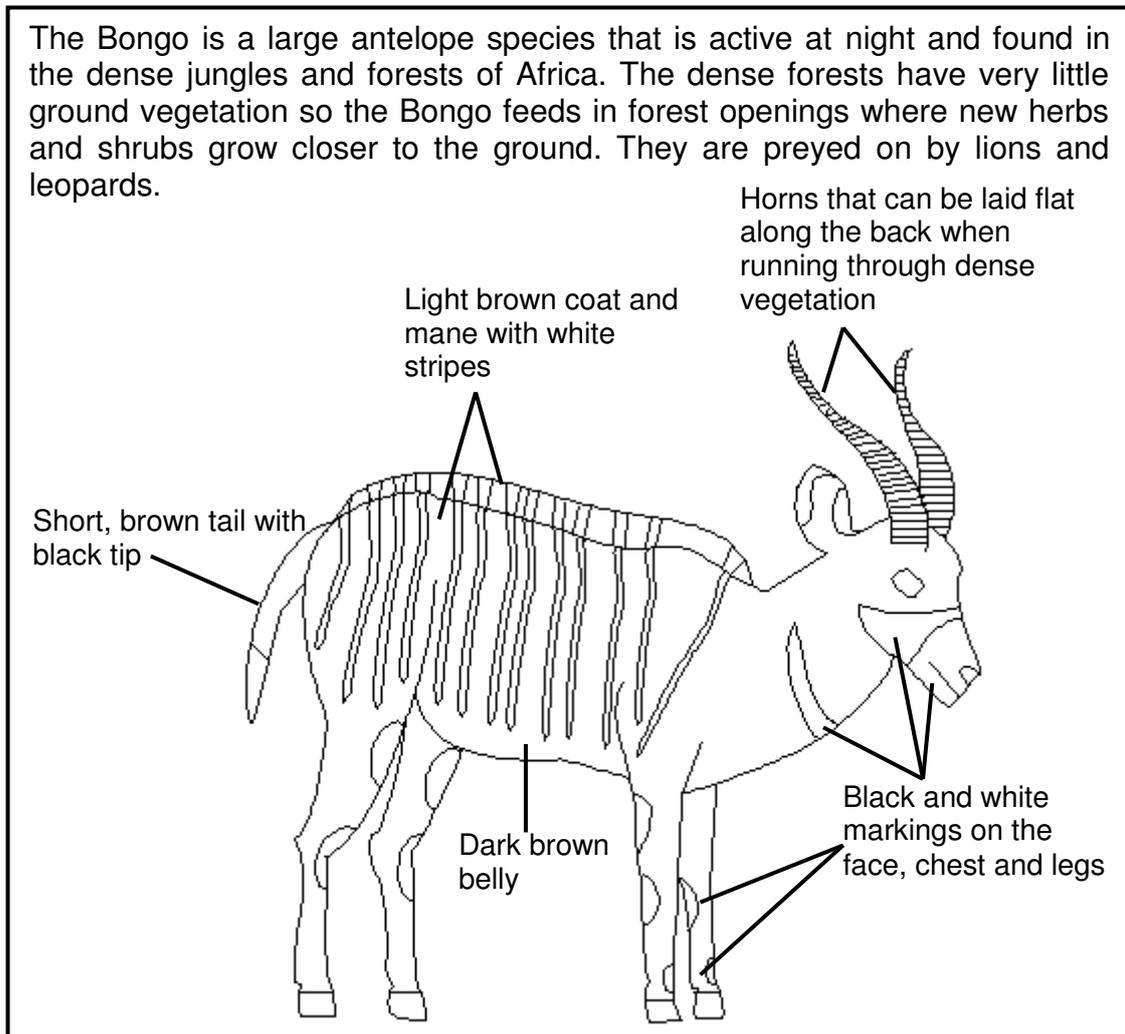
Use a genetic cross to show how it is possible for them to have a child with blood group **O**. (6)
(11)

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.

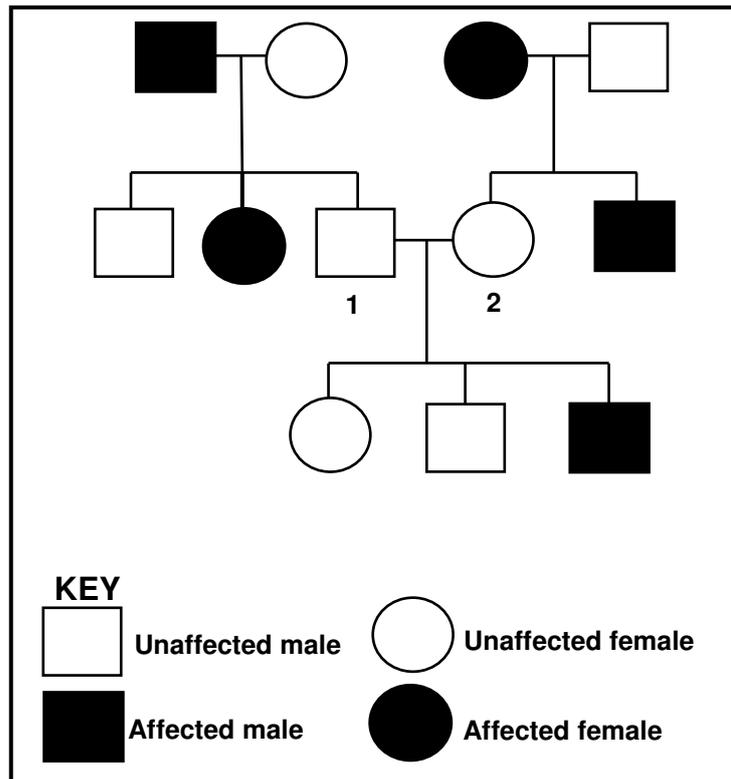
3.2.1 Tabulate THREE structural differences between DNA and RNA. (7)

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)

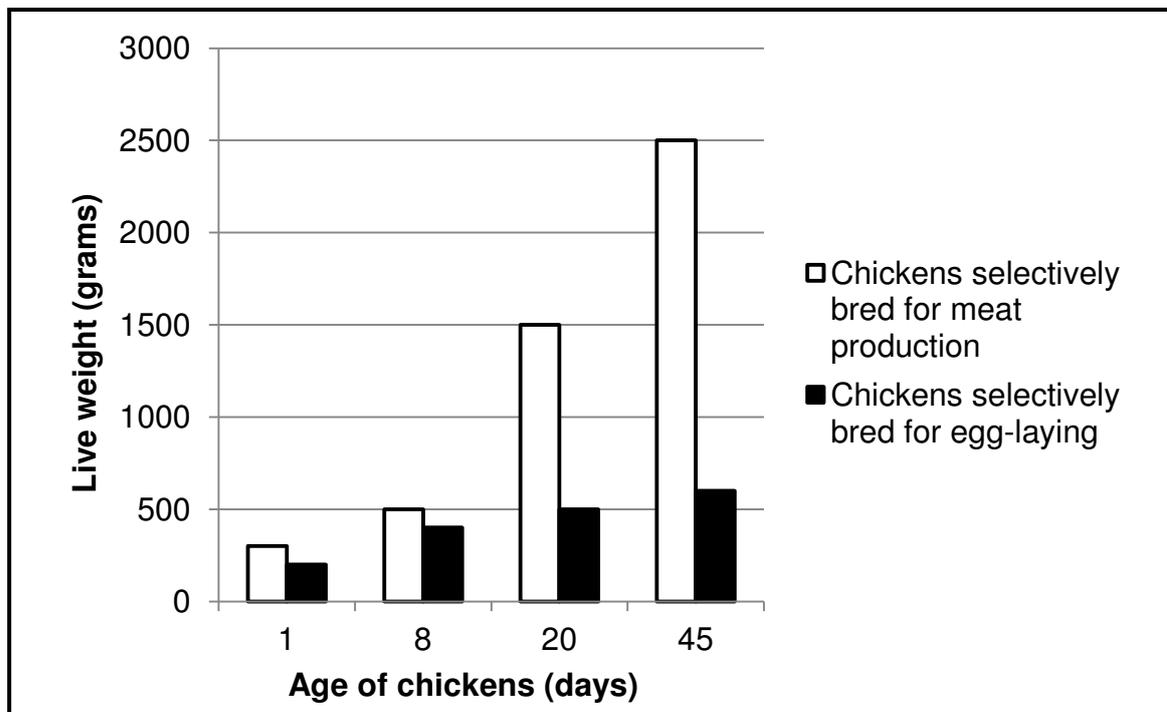
(9)

- 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]

- 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



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

LIFE SCIENCES P2

NOVEMBER 2015

MEMORANDUM 2015

MARKS: 150

This memorandum consists of 12 pages.

PRINCIPLES RELATED TO MARKING LIFE SCIENCES

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 a part of it is required**
Read all and credit the relevant part.
4. **If comparisons are asked for but descriptions are given**
Accept if the 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 or diagrams are given instead of descriptions**
Candidates will lose marks.
8. **If sequence is muddled and links do not make sense**
Where the sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If sequence and links become correct again, resume credit.
9. **Non-recognised abbreviations**
Accept if first defined in answer. If not defined, do not credit the unrecognised abbreviation but credit the rest of the 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 recognisable, accept the answer, provided it does not mean something else in Life Sciences or if it is out of context.
13. **If common names are given in terminology**
Accept, provided it was accepted at the national memo discussion meeting.
14. **If only the letter is asked for but only the name is given (and vice versa)**
Do not 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 appear(s) 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.
19. **Changes to the memorandum**
No changes must be made to the memoranda without consulting the provincial internal moderator who in turn will consult with the national internal moderator (and the Umalusi moderators where necessary).
20. **Official memoranda**
Only memoranda bearing the signatures of the national internal moderator and the Umalusi moderators and distributed by the national Department of Basic Education via the provinces must be used.

SECTION A**QUESTION 1**

| | | | | |
|-----|-------|--|---------|-------------------|
| 1.1 | 1.1.1 | C✓✓ | | |
| | 1.1.2 | D✓✓ | | |
| | 1.1.3 | B✓✓ | | |
| | 1.1.4 | C✓✓ | | |
| | 1.1.5 | A✓✓ | | |
| | 1.1.6 | A✓✓ | | |
| | 1.1.7 | B✓✓ | | |
| | 1.1.8 | D✓✓ | | |
| | 1.1.9 | B✓✓ | (9 x 2) | (18) |
| 1.2 | 1.2.1 | Homologous✓/homologues/bivalent | | |
| | 1.2.2 | Alleles✓/Multiple alleles | | |
| | 1.2.3 | Spindle fibres✓/spindle threads/spindle apparatus | | |
| | 1.2.4 | Interphase✓ | | |
| | 1.2.5 | Phylogenetic tree✓/cladogram | | |
| | 1.2.6 | Binocular✓/stereoscopic | | |
| | 1.2.7 | Dihybrid✓cross | | |
| | 1.2.8 | Haemophilia✓ | | |
| | 1.2.9 | Biogeography✓ | (9 x 1) | (9) |
| 1.3 | 1.3.1 | B only✓✓ | | |
| | 1.3.2 | Both A and B ✓✓ | | |
| | 1.3.3 | B only✓✓ | | |
| | 1.3.4 | A only✓✓ | (4 x 2) | (8) |
| 1.4 | 1.4.1 | (a) B✓ | | (1) |
| | | (b) B✓ | | (1) |
| | | (c) A✓ | | (1) |
| | | (d) A✓ | | (1) |
| | 1.4.2 | Mrs Ples✓ Taung Child✓ } <i>A. africanus</i> Little Foot✓/ <i>A. prometheus</i> Karabo✓/ <i>A. sediba</i> (Mark first TWO only) | Any 2 | (2) |
| | 1.4.3 | Site 4✓ | | (1) |
| | 1.4.4 | Mitochondrial DNA✓/mtDNA/genetic evidence/ Y-chromosome/cultural evidence (Mark first ONE only) | | (1) (8) |

QUESTION 2

- 2.1 2.1.1 - Conditions/example on the island probably remained the same✓
 - so they experienced the same selection pressure✓
 - species A was already suited to those conditions✓ Any 2 (2)
- 2.1.2 - The original species was separated✓ into three/different
 populations
 - **by the sea**✓*
 - which acted as a geographical barrier✓
 - There was no gene flow✓ between the populations
 - Each population was exposed to different environmental
 conditions✓
 - Natural selection occurred independently✓ in each population
 - and the individuals of each population became different✓ from
 each other over time
 - genotypically✓/phenotypically
 - Even if the three populations were to mix again✓
 - they would not be able to reproduce with each
 other✓/interbreed 1 *Compulsory mark + Any 5 (6)
 (8)
- 2.2 2.2.1 - The blood groups of the mother, possible father and the child
 must be compared✓.
 - If this shows that it is not possible that these parents can
 produce a child with his/her blood group✓
 - then this man is not the father✓
 - If this shows that it is possible that these parents can produce a
 child with his/her blood group✓
 - then he may/may not be the father✓
 - because other males have the same blood group✓ Any 5 (5)

2.2.2

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

Meiosis

G/gametes I^B, i x I^B, i ✓

Fertilisation

F₁ Genotype $\frac{I^B I^B; I^B i; I^B i; ii}{}$ ✓
 Phenotype 3 blood group B : 1 blood group O ✓

P₁ and F₁ ✓
 Meiosis and fertilisation ✓

Any 6

OR

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

Meiosis

Fertilisation

| | | |
|----------------|-------------------------------|------------------|
| Gametes | I ^B | i |
| I ^B | I ^B I ^B | I ^B i |
| i | I ^B i | ii |

1 mark for correct gametes
 1 mark for correct genotypes

F₁ Phenotype 3 blood group B : 1 blood group O ✓

P₁ and F₁ ✓
 Meiosis and fertilisation ✓

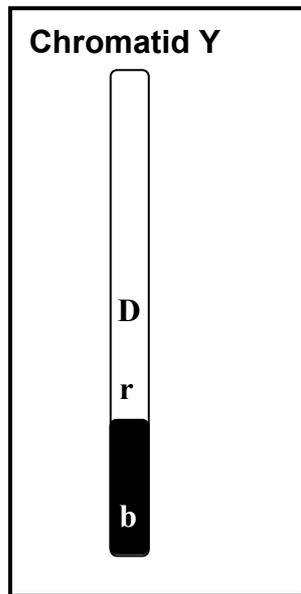
Any 6 (6)
(11)

2.3 2.3.1 Prophase I ✓ (1)

- 2.3.2
- Homologous chromosomes lie next to each other ✓
 - Chromatids overlap ✓/touch
 - at points called chiasmata ✓
 - and genetic information is exchanged ✓/swapped
- Any 3 (3)

- 2.3.3
- Crossing over introduces genetic variation ✓ in gametes
 - It may lead to new characteristics which are favourable ✓
 - or new characteristics which are unfavourable ✓
 - therefore affecting the chances of survival of the organism ✓/ natural selection.
- Any 2 (2)

2.3.4



| ASSESSING THE DIAGRAM | |
|---|-------|
| CRITERIA | MARKS |
| Chromatid Y represented (must be labelled if a whole chromosome is represented) | 1 |
| Alleles indicated correctly | 1 |

(2)
(8)

- 2.4 2.4.1 - Coat is light brown✓ on the upper side
 - Dark brown belly✓
 - White stripes on the back and mane✓
 - Black and white patches on the rest of the body✓
 - The tip of the tail is black✓
(Mark first TWO only) Any 2 (2)
- 2.4.2 - There is variation✓ amongst the Bongo population
 - Some have horns that can be laid on their backs✓
 - while others do not have horns that can be laid on their backs✓
 - The antelope must move through dense vegetation✓ without their horns getting entangled in the vegetation
 - Those with horns that cannot be laid on their backs become entangled✓/ die
 - Those with horns that can be laid on their backs do not become entangled and escape predators✓/survive
 - Those with horns that can be laid back will reproduce✓
 - and pass the gene for horns that can be laid on their backs to the next generation✓
 - Over many years the proportion of animals that are able to lay their horns on their backs, increases✓
 Any 5 (5)
(7)
- 2.5 2.5.1 - Characteristics that are desirable/beneficial to humans✓ are being selected
 - The characteristics are chosen by humans✓/It is an artificial process
 - It is not necessarily beneficial for the organism✓
(Mark first TWO only) Any 2 (2)
- 2.5.2 - The long-term effects on health are unknown✓ which could lead to health problems in the future✓
 - The long-term effects on the environment are unknown✓ leading to environmental damage✓/loss of biodiversity/ damaging ecosystems/nature
 - People are morally opposed✓ as humans are interfering with nature✓/playing God/interfering with the rights of every species
 - Initially it is an expensive process✓ and many people/countries may not be able to afford it✓
(Mark first TWO only) (Any 2 x 2) (4)
(6)
[40]

QUESTION 3

- 3.1 3.1.1 - More mistakes are made✓/high rates of mutation
- when RNA is copied✓/than when DNA is copied (2)
- 3.1.2 - A mutation could allow the virus to be transmitted through the air✓
- This would allow the virus to be spread more easily✓ (2)
(4)
- 3.2 3.2.1
- | DNA | RNA |
|--|--|
| 1. Double stranded✓ molecule | 1. Single stranded✓ molecule |
| 2. Has a helix✓ shape | 2. Is a straight molecule✓ |
| 3. One of the nitrogen bases is thymine✓ | 3. The nitrogen base uracil✓ in place of thymine |
| 4. Contains deoxyribose✓ sugars | 4. Contains ribose✓ sugars |
| 5. A longer ✓ molecule | 5. A shorter✓ molecule |
| 6. Paired bases✓ | 6. Unpaired bases✓ |
- (Mark first THREE only) (Any 3 x 2) table +1 (7)
- 3.2.2 Helps to:
- Solve crimes✓/criminal investigations
- Identify organisms from their tissues✓
- Identify family relationship✓
- Test for specific alleles that can cause a genetic disorder✓
- Establish matching tissues for organ transplants✓
- Used in research into variation in populations ✓
(Mark first TWO only) Any 2 (2)
- 3.2.3 - Samples containing DNA can be planted✓/person was framed
- Human error✓ during DNA profiling process
- Costly procedure✓
- Invasion of privacy✓
(Mark first TWO only) Any 2 (2)
(11)
- 3.3 3.3.1 (a) $X^A Y$ ✓✓ (2)
(b) $X^A X^a$ ✓✓ (2)
- 3.3.2 $\left[\frac{3}{7} \times 100 \right] \checkmark = 42,86\checkmark/42,9/43\%$ (2)
- 3.3.3 - An affected female carries two/only recessive alleles✓/ $X^a X^a$
- Sons/males inherit one X chromosome✓ from their mothers
- Sons/males need only one recessive allele to be affected✓
- And therefore must inherit X^a from their mother✓
Any 3 (3)
(9)

- 3.4 3.4.1 - The meat/egg chickens will grow faster/slower than the egg/meat chickens✓✓
OR
- There will be no difference in the rate of growth of the two types of chicken✓✓ (2)
- 3.4.2 The type✓/age of chicken. (1)
- 3.4.3
$$\left[\frac{2500 - 500}{500} \times 100 \right] \checkmark = 400 \checkmark \%$$
 (2)
- 3.4.4 Increase✓ the reliability✓ (2)
- 3.4.5 - The same person must weigh the chicks✓ to get accurate results
- The same scale✓ must be used to weigh the chicks
- The chicks must be weighed at the same time of day✓
- Same environmental conditions✓/example
- Same type of food✓
- The same amount of food✓
- The same feeding time✓
- Cages must be the same size✓
- Chickens must be female✓
- Age of the chickens✓
- Same number of chickens in each sample group✓
- **(Mark first THREE only)** Any 3 (3)
- 3.4.6 The chickens that underwent selective breeding for meat production grow faster than chickens bred for egg laying✓✓
OR
The chickens that underwent selective breeding for egg laying grow slower than chickens bred for meat production✓✓
OR
The weight of the chickens increases with age✓✓/time (2)
- 3.4.7 - Products produced more quickly✓
- Increased resistance to diseases✓
- Improved quality of (chicken) products✓
- Improved yield of (chicken) products✓ Any 2 (2)
- 3.4.8 - The chickens are larger✓/heavier so they cannot run away from predators✓
- The chickens are larger✓ and is more visible to predators✓
- Decreased variation✓ therefore more susceptible to diseases✓
(Mark first ONE only) Any 1 x 2 (2)
- (16)**
[40]
80
- TOTAL SECTION B:**

SECTION C**QUESTION 4****PROTEIN SYNTHESIS****Transcription✓ (T)**

- Double stranded DNA unwinds ✓
- and unzips when ✓
- the hydrogen bonds break ✓
- and this is controlled by enzymes ✓
- One strand is used as a template ✓
- to form mRNA ✓
- using free RNA nucleotides from the nucleoplasm ✓
- The mRNA is complementary to the DNA ✓
- mRNA now has the coded message for protein synthesis ✓

Translation✓ (S)

- mRNA moves from the nucleus ✓/to the ribosome
- Each tRNA carries an amino acid ✓
- tRNA carries the amino acid to the ribosome ✓
- When the anticodon on the tRNA ✓
- matches the codon on the mRNA ✓
- Amino acids become attached ✓ in the sequence determined by the mRNA
- by peptide bonds ✓
- to form the required protein ✓

Max 13

EFFECTS OF A MUTATION (M)

- A gene mutation affects arrangement/type of the nitrogen bases ✓/nucleotides
- This changes the code on the DNA ✓
- which changes the code on the RNA ✓
- A different amino acid ✓ may be coded for
- which causes a change in the amino acid sequence ✓ in the protein
- leading to the formation of a different/alternate/no protein

Max 4 (17)
Content: (3)
Synthesis: (20)

ASSESSING THE PRESENTATION OF THE ESSAY

| Criterion | Relevance (R) | Logical sequence (L) | Comprehensive (C) |
|----------------------------|---|--|---|
| Generally | All information provided is relevant to the question | Ideas are arranged in a logical/cause-effect sequence | All aspects required by the essay have been sufficiently addressed |
| In this essay in Q4 | Only information relevant to the description of protein synthesis and the effects of mutation on the process is given | The description of protein synthesis and the effects of mutation on the process given are logical and sequential | At least 5 correct points in the description of transcription and 5 correct points in the description of translation and 2 correct points on the effects of mutation |
| Mark | 1 | 1 | 1 |

TOTAL SECTION C: 20
GRAND TOTAL: 150