



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P1

NOVEMBER 2014

MARKS: 150

TIME: 2½ hours

This question paper consists of 14 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 The part of the brain that interprets impulses from the retina of the eye is the ...
- A cerebrum.
 - B cerebellum.
 - C medulla oblongata.
 - D corpus callosum.
- 1.1.2 Which ONE of the following hormones is responsible for the development of secondary male characteristics?
- A FSH
 - B Testosterone
 - C Oestrogen
 - D Progesterone
- 1.1.3 The number of chromosomes found in a human sperm cell is ...
- A 23.
 - B 22.
 - C 46.
 - D 47.
- 1.1.4 A patient suffers from an undersecretion of ADH. This will lead to ...
- A a high concentration of sodium in the urine.
 - B the presence of glucose in the urine.
 - C decreased thirst.
 - D the formation of large volumes of urine.
- 1.1.5 Damage to the dendrites of a motor neuron in a reflex arc would probably prevent ...
- A a receptor from receiving a stimulus.
 - B synaptic contact with a sensory neuron.
 - C an impulse from being transmitted to an effector organ.
 - D an impulse from being transmitted to the spinal cord.

- 1.1.6 The part of the brain that regulates breathing is the ...
- A medulla oblongata.
 - B cerebrum.
 - C corpus callosum.
 - D cerebellum.
- 1.1.7 Grommets may be used in the treatment of ...
- A astigmatism.
 - B cataracts.
 - C middle ear infections.
 - D long-sightedness.
- 1.1.8 Which ONE of the following is a response of the human body when adrenalin is released?
- A Decreased oxygen intake
 - B Increased blood flow to the intestines
 - C Decreased blood flow to the muscles and heart
 - D Increased conversion of glycogen to glucose
- 1.1.9 In gamete formation in human females, each diploid cell forms ...
- A four diploid gametes.
 - B one diploid gamete.
 - C one haploid gamete.
 - D two haploid gametes.
- 1.1.10 Crossing-over and random arrangement of chromosomes occur respectively in ...
- A prophase II and metaphase II.
 - B prophase I and metaphase I.
 - C prophase II and anaphase II.
 - D prophase I and anaphase I.
- (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 1.2.10) in the ANSWER BOOK.

- 1.2.1 The membranes which protect the central nervous system
- 1.2.2 A plant growth hormone that stimulates seed germination
- 1.2.3 The nervous system which consists of cranial and spinal nerves
- 1.2.4 A branch of the autonomic nervous system that decreases the heartbeat back to normal
- 1.2.5 The outermost extra-embryonic membrane surrounding the embryo
- 1.2.6 The hormone that regulates the salt concentration in the human body
- 1.2.7 The blood vessel in the umbilical cord that carries blood rich in oxygen and nutrients
- 1.2.8 The hormone inhibited by an increased level of thyroxine
- 1.2.9 The period of development of an embryo in the uterus, between fertilisation and birth
- 1.2.10 The structure in the head of a sperm cell that contains enzymes which break down the membrane surrounding the ovum (10 x 1) **(10)**

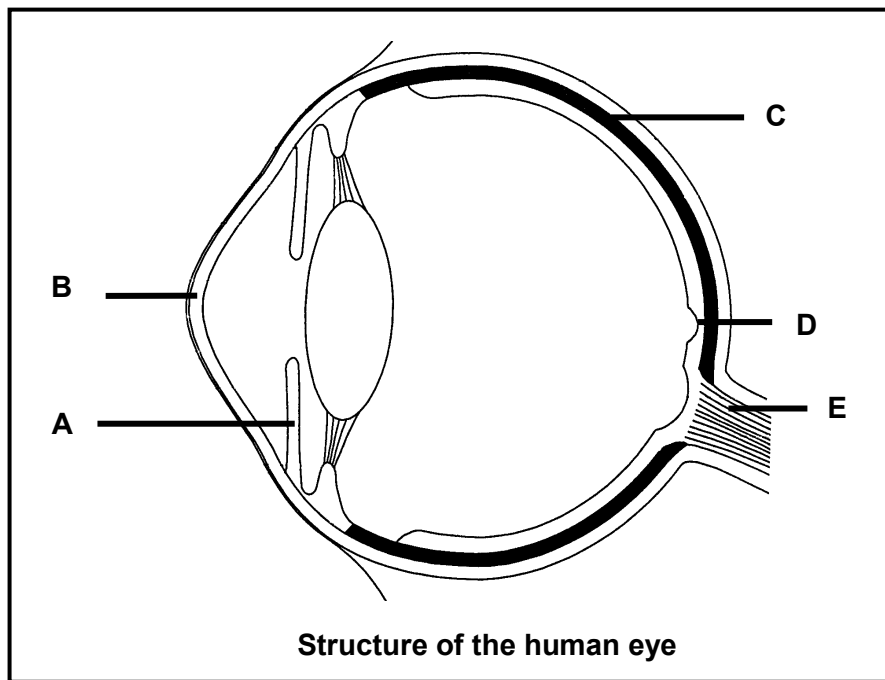
1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.5) in the ANSWER BOOK.

| COLUMN I | COLUMN II |
|---|--|
| 1.3.1 Embryo is nourished with yolk found in the egg | A: Ovipary B: Vivipary |
| 1.3.2 Gas produced when organic matter decomposes | A: Chlorofluorocarbons (CFCs) B: Methane |
| 1.3.3 Foetus is attached to the mother's uterus | A: Ovipary B: Ovovivipary |
| 1.3.4 Young bird cannot feed or move independently after hatching | A: Precocial development B: Altricial development |
| 1.3.5 Decreases biodiversity | A: Alien plant invasion B: Urbanisation |

(5 x 2)

(10)

1.4 The diagram below represents the structure of the human eye.



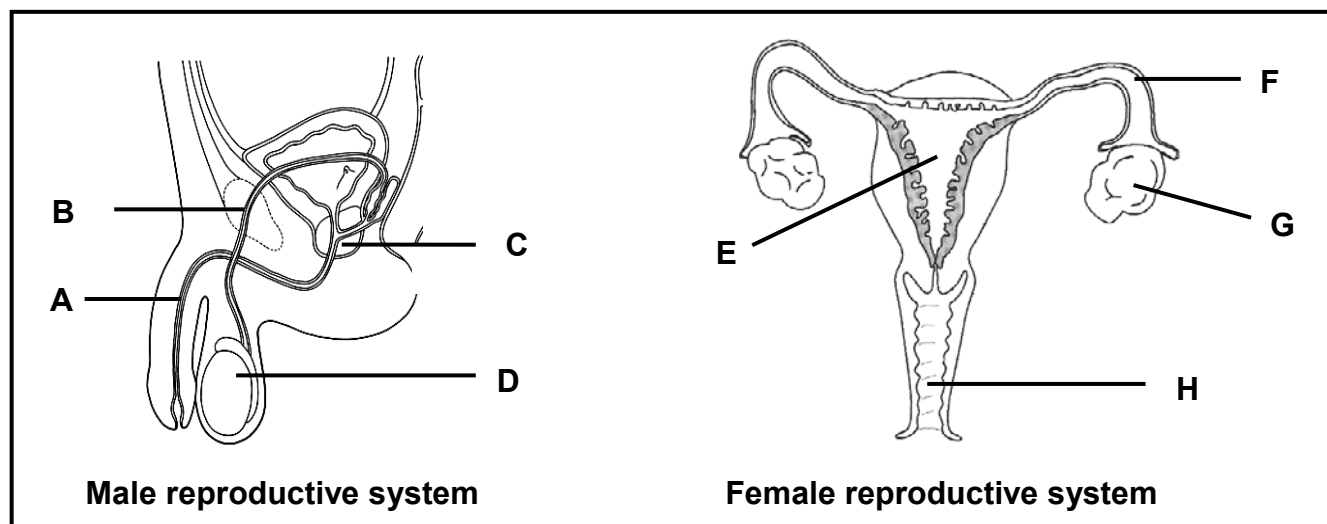
Give the LETTER and the NAME of the part which:

- | | | |
|-------|---|-------------|
| 1.4.1 | Regulates the amount of light entering the eye | (2) |
| 1.4.2 | Supplies food and oxygen to the eye | (2) |
| 1.4.3 | Transmits impulses to the brain | (2) |
| 1.4.4 | Contains cones and is the area of clearest vision | (2) |
| 1.4.5 | Assists in the refraction of light rays | (2) |
| | | (10) |

TOTAL SECTION A: 50

SECTION B**QUESTION 2**

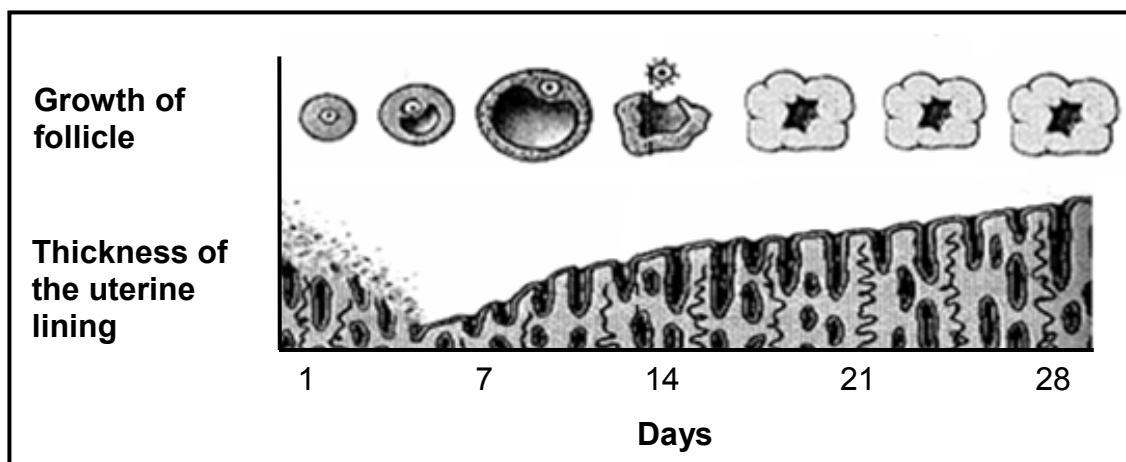
- 2.1 Study the diagrams below showing the male and female reproductive systems.



- 2.1.1 Identify parts **A**, **B** and **F** respectively. (3)
- 2.1.2 State ONE function of each of the following:
- (a) The fluid produced by part **C** (1)
 - (b) Part **E** (1)
- 2.1.3 Give the LETTER ONLY of the organ where meiosis takes place in the:
- (a) Male reproductive system (1)
 - (b) Female reproductive system (1)
- 2.1.4 Name the type of gametogenesis that takes place in the:
- (a) Male reproductive system (1)
 - (b) Female reproductive system (1)
- 2.1.5 State TWO functions of part **H**. (2)
- 2.1.6 Explain why it is necessary for part **D** to be 'outside' the body in males. (2)

(13)

- 2.2 The diagram below shows some of the changes that take place during the menstrual cycle.

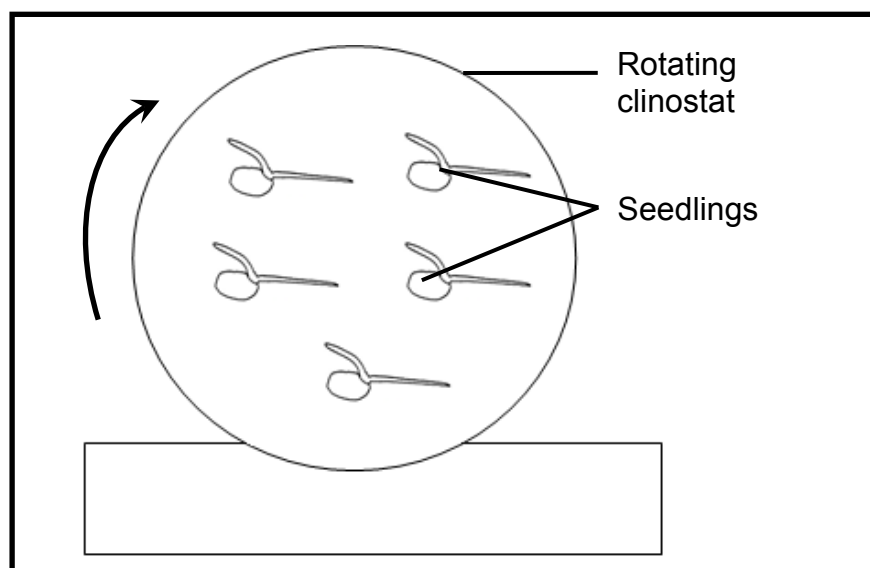


- 2.2.1 The menstrual cycle is controlled by hormones. Name ONE hormone which will increase in level between day 2 and day 10. (1)
- 2.2.2 Give ONE observable reason for your answer to QUESTION 2.2.1. (2)
- 2.2.3 Explain evidence from the diagram which indicates that fertilisation took place. (3)
- 2.2.4 Describe the developmental changes in the fertilised ovum until implantation occurs in the uterus. (5)
- 2.2.5 Some females use an ovulation monitor so that they can be aware of the days when they are fertile. These monitors measure the level of hormones in the blood.
- (a) Why would females want to know when they are fertile? (1)
- (b) Explain which hormone is likely to be monitored by the ovulation monitor. (3)
- (15)**

2.3 A learner conducted an investigation to determine the effect of auxins and the effect of gravity on root growth in pea seedlings. He used the following procedure:

- He germinated pea seeds for seven days.
- He then took a sample of 15 seedlings and divided them into 3 groups (A to C) of 5 seedlings each.
- In each group the 5 seedlings were placed **horizontally** on 3 different clinostats.

A clinostat is a device which has a disc that rotates at a constant speed. A diagram of a clinostat is shown below.



- He removed the root tips of all 5 seedlings at the same length in group B.
- In groups A and B the clinostats were left stationary (no rotation).
- In group C the clinostat was allowed to rotate.
- All 3 clinostats were placed in a dark cupboard.

A summary of the learner's procedure is shown in the table below.

| GROUP A | GROUP B | GROUP C |
|----------------------|----------------------|--------------------|
| Root tips present | No root tips | Root tips present |
| Stationary clinostat | Stationary clinostat | Rotating clinostat |

After two days the direction of root growth was observed.

- 2.3.1 Which TWO groups were used to obtain information about:
- (a) The effect of auxins on root growth (1)
 - (b) The effect of gravity on root growth (1)
- 2.3.2 Explain why the apparatus was placed in a dark cupboard. (2)
- 2.3.3 Describe the expected results for each of groups **B** and **C** in this investigation. (2)
- 2.3.4 Explain the expected results for group **A**. (3)
- 2.3.5 State THREE ways in which the learner ensured a high level of validity for this investigation. (3)
- (12)**
[40]

QUESTION 3

3.1 A farmer conducted an investigation to determine which type of fertiliser would increase the yield of her wheat crop.

- She divided her farm into three 1 hectare plots and treated them as follows:

| Treatment | Hectare A | Hectare B | Hectare C |
|---------------------------|-----------|-------------------|---------------------|
| Type of fertiliser | None | Contains nitrogen | Contains phosphorus |
| Amount of fertiliser (kg) | None | 10 | 10 |

- She planted the same type of crop, namely wheat, during November each year for five years.
- She used water from a river which flows through the farm to irrigate her crop.
- She recorded the yield per plot for each year. The yield was measured by calculating the number of kilograms of wheat produced per hectare.

- 3.1.1 Identify the dependent variable in this investigation. (1)
- 3.1.2 Explain the purpose of including hectare **A** in this investigation. (2)
- 3.1.3 State ONE way in which the farmer could have increased the reliability of her results. (1)
- 3.1.4 If this investigation was carried out for more than five years, list THREE negative effects of planting the same type of crop over many years on the same plot of land. (3)
- 3.1.5 Explain how the excessive use of fertilisers can affect biodiversity if it is washed into the river. (4)
- (11)**

3.2 Read the passage below about food wastage around the world.

FOOD WASTAGE AROUND THE WORLD

Every year a third of all food for human consumption, about 1,3 billion tons, is wasted in the world. The UN Food and Agriculture Organisation (FAO) estimated that the carbon footprint of wasted food was equivalent to 3,3 billion tons of carbon dioxide a year. The FAO suggests that more efficient use of food could contribute to global efforts to cut greenhouse gases to limit global warming.

In the industrialised world, much of the waste comes from consumers buying too much and throwing away what they do not eat. In developing countries it is mainly the result of inefficient farming and a lack of proper storage facilities.

[Adapted from: *Reuters Daily News*, September 2013]

3.2.1 What is meant by the following terms:

(a) Carbon footprint (2)

(b) Food security (2)

3.2.2 Explain how wastage of food contributes to loss of energy and global warming. (4)

3.2.3 Use the information in the passage to suggest TWO ways in which food wastage could be reduced. (2)
(10)

3.3 The table below shows how body temperature is regulated by the hypothalamus by influencing heat production and heat loss.

| BODY TEMPERATURE (°C) | HEAT PRODUCTION (JOULES PER SECOND) | HEAT LOSS (JOULES PER SECOND) |
|-----------------------|-------------------------------------|-------------------------------|
| 36,4 | 320 | 5 |
| 36,6 | 260 | 5 |
| 36,8 | 150 | 35 |
| 36,9 | 90 | 90 |
| 37,0 | 90 | 100 |
| 37,2 | 90 | 180 |
| 37,4 | 90 | 310 |

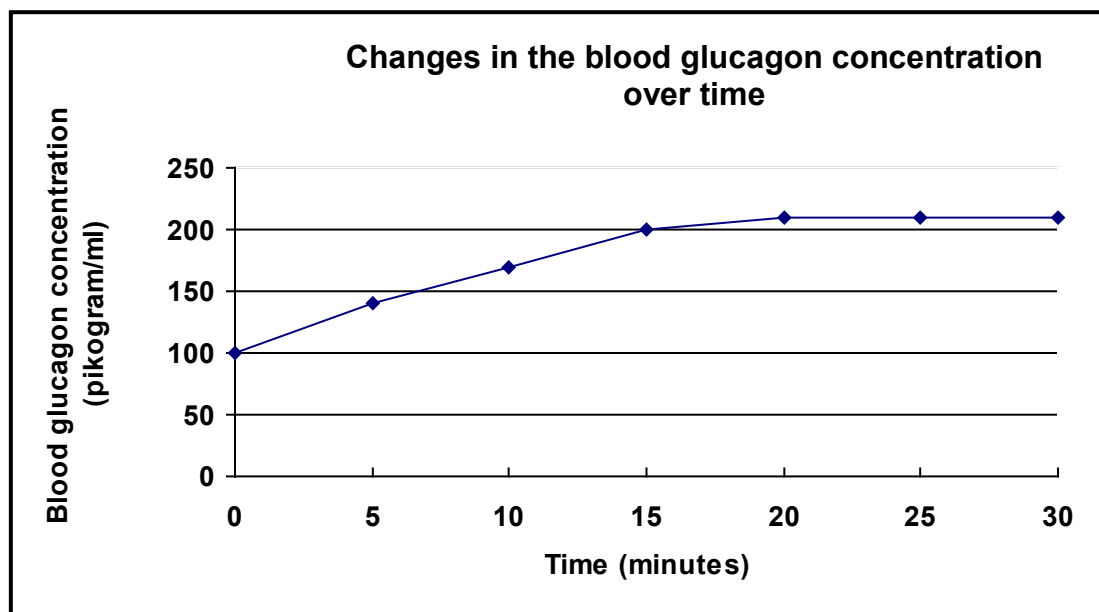
[Adapted from *Cambridge Biology*, 2002]

3.3.1 Are the blood vessels that supply blood to the skin constricted or dilated when the body temperature is 36,4 °C? (1)

3.3.2 Explain the advantage of the diameter of the blood vessels (constricted/dilated) mentioned in your answer to QUESTION 3.3.1. (4)

3.3.3 Heat loss is the greatest at 37,4 °C. Explain how the body is able to increase heat loss. (4)
(9)

- 3.4 Study the graph below showing the changes in the glucagon concentration during exercise.



- 3.4.1 Describe the trend for the changes in the glucagon level over time. (3)
- 3.4.2 Explain the changes in the level of glucagon from 0 to 10 minutes. (3)
- 3.4.3 Taking into account the pattern for glucagon concentration from 0 to 10 minutes in the graph above, what will you expect to happen to the insulin concentration for the same period? (1)
- 3.4.4 Explain why people with diabetes mellitus have very little glycogen in their liver and muscle cells. (3)
- (10)**
[40]

TOTAL SECTION B: 80

SECTION C**QUESTION 4**

A goalkeeper in a soccer match prevented a goal from being scored when he dived to his right after the ball was kicked towards him. Just before he dived, he heard his team-mate shout, 'your ball'.

Describe how his eyes adjusted to see the ball as it travelled towards him and describe how he heard his team-mate and maintained his balance as he dived to save the ball.

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

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

TOTAL SECTION C: 20
GRAND TOTAL: 150



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NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P1

NOVEMBER 2014

MEMORANDUM

MARKS: 150

This memorandum consists of 10 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 part of it is required**
Read all and credit relevant part.
4. **If comparisons are asked for but 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-recognized abbreviations**
Accept if first defined in answer. If not defined, do not credit the unrecognised 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. Indicate that the candidate's numbering is wrong.
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.
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 name is given (and vice versa)**
No credit.
15. **If units are not given in measurements**
Memorandum will allocate marks for units separately, except where it is already given in the question.
16. Be sensitive to **the sense of an answer, which may be stated in a different way.**
17. **Caption**
Credit will be given for captions to all illustrations (diagrams, graphs, tables, etc.) except where it is already given in the question.
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.
19. **Changes to the memorandum**
No changes must be made to the marking memoranda. In exceptional cases, the Provincial Internal Moderator will consult with the National Internal Moderator (and the External moderators if necessary).
20. **Official memorandum**
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 | B✓✓ | | |
| | 1.1.3 | A✓✓ | | |
| | 1.1.4 | D✓✓ | | |
| | 1.1.5 | C✓✓ | | |
| | 1.1.6 | A✓✓ | | |
| | 1.1.7 | C✓✓ | | |
| | 1.1.8 | D✓✓ | | |
| | 1.1.9 | C✓✓ | | |
| | 1.1.10 | B✓✓ | (10 x 2) | (20) |
| 1.2 | 1.2.1 | Meninges✓ | | |
| | 1.2.2 | Gibberellin✓ | | |
| | 1.2.3 | Peripheral ✓ nervous system | | |
| | 1.2.4 | Parasympathetic✓ system | | |
| | 1.2.5 | Chorion✓ | | |
| | 1.2.6 | Aldosterone✓ | | |
| | 1.2.7 | Umbilical vein✓ | | |
| | 1.2.8 | TSH✓ /thyroid stimulating hormone | | |
| | 1.2.9 | Gestation✓ | | |
| | 1.2.10 | Acrosome✓ | | (10) |
| 1.3 | 1.3.1 | A only✓✓ | | |
| | 1.3.2 | B only✓✓ | | |
| | 1.3.3 | None✓✓ | | |
| | 1.3.4 | B only✓✓ | | |
| | 1.3.5 | Both A and B✓✓ | (5 x 2) | (10) |
| 1.4 | 1.4.1 | A✓ - Iris✓ | | (2) |
| | 1.4.2 | C✓ - Choroid✓ | | (2) |
| | 1.4.3 | E✓ - Optic nerve✓ | | (2) |
| | 1.4.4 | D✓ - Fovea✓/yellow spot | | (2) |
| | 1.4.5 | B✓ - Cornea✓ | | (2) |
| | | | | (10) |

TOTAL SECTION A: 50

SECTION B**QUESTION 2**

- 2.1 2.1.1 A - Urethra✓
B - Vas deferens✓/sperm duct
F - Fallopian tube✓/oviduct (3)
- 2.1.2 (a) - Protects the sperm cell against the acidic environment of the vagina✓
- Increases the motility of the sperm✓
- Provides nutrients✓
(Mark first ONE only) Any (1)
- (b) - Place for foetus to develop ✓
- Maintain pregnancy✓
- Assist in childbirth✓
- Implantation✓ of blastula
- Protects the foetus✓/prevents infections(mucus plug forms by cervix)
- Passage for sperm cells✓between vagina and fallopian tubes
(Mark first ONE only) Any (1)
- 2.1.3 (a) D✓ (1)
(b) G✓ (1)
- 2.1.4 (a) Spermatogenesis✓ (1)
(b) Oogenesis✓ (1)
- 2.1.5 - Serves as a birth canal✓
- Allows for passage of blood/ endometrial lining/amniotic fluid/placenta
- Facilitates sexual intercourse ✓/receives semen
- Secretes acid which prevents infections✓
(Mark first TWO only) Any (2)
- 2.1.6 - To keep the testes at a temperature that is lower than body temperature✓/optimum temperature for sperm production
- which is necessary for the production of healthy sperm✓/so that healthy sperms can survive (2)
(13)
- 2.2 2.2.1 FSH✓
OR
Oestrogen✓
(Mark first ONE only) Any (1)
- 2.2.2 -The follicle✓develops✓ during this period stimulated by increased levels of FSH
-The lining of the endometrium✓ thickens✓ during this period stimulated by increased levels of oestrogen
(Mark first ONE only) Any(1 x 2) (2)

- 2.2.3 - Corpus luteum has not disintegrated✓
- it continues to secrete progesterone✓
- so the endometrial lining remains thickened✓ (3)
- 2.2.4 - The zygote✓
- undergoes mitosis✓
- until a ball of cells is formed✓
- called a morula✓
- The morula continues to divide and forms a mass of cells with a hollow cavity✓
- called a blastocyst✓
- the outer membrane of the blastocyst forms chorionic villi✓/
attachment villi
- which attaches it to the endometrium✓ Any (5)
- 2.2.5 (a) For family planning✓/ to know when they can get pregnant (1)
- (b) LH✓/FSH/oestrogen
- There is a rise in levels✓ of LH/FSH/oestrogen
- around the time of ovulation✓ (3)
- 2.3 2.3.1 (a) A and B✓ (1)
- (b) A and C✓ (1)
- 2.3.2 - To ensure that the results are attributed to gravity✓
- and not light✓/ to eliminate the effect of light (2)
- 2.3.3 B – No growth will be observed✓
C – Roots will grow **horizontally**✓/not change direction (2)
- 2.3.4 - Auxins will move to the lower side of the root✓/attracted by gravity
- and a high concentration will inhibit growth on the lower side of the roots✓
- while growth will occur faster on the upper side of the root✓
- causing the root to bend downwards✓ Any (3)
- 2.3.5 - Used same type of plant✓/pea only
- Seedlings were the same age✓/germination period was 7 days
- All groups were exposed to the same environment✓/light intensity/ placed in dark cupboard
- Same number of seedlings for each group✓
- Root tips were cut at the same length✓
- All seedlings placed in same position✓/horizontally
- Allowed same amount of time for the 3 groups✓
- Appropriate controls were set up✓ Any (3)
- (Mark first THREE only)** (12)
- [40]**

QUESTION 3

- 3.1 3.1.1 Number of kilograms of wheat per hectare✓/Yield (1)
- 3.1.2 To compare✓the yield obtained when using two types of fertiliser with the yield of the hectare with no fertiliser✓
OR
It acts as a control✓ - to ensure that the results obtained are due to the addition of fertilisers✓ and not any other factor
Any(1x2) (2)
- 3.1.3 - She could have increased the sample size✓/number of plots/ number of plants for each type of fertiliser used
- Repeated the investigation✓
(Mark first ONE only) Any (1)
- 3.1.4 - Depletes nutrients in the soil✓
- Leads to decrease in yield✓
- Increases pests✓
- Leads to soil erosion✓
- Decreases biodiversity✓
(Mark first THREE only) Any (3)
- 3.1.5 - The excessive use of fertilisers increases the nutrient content✓of the surrounding river /eutrophication occurs/ water becomes polluted
- This causes an increase in algal growth✓ /algal bloom
- The algae block out light✓
- reducing photosynthesis✓
- Plants and animals depending on them die✓
- increasing decomposition✓
- leading to a depletion of oxygen✓
- and reducing the biodiversity✓/reducing the number of animal and plant species in the river
Any (4)
(11)
- 3.2 3.2.1 (a) - Carbon footprint is a measure of the total amount of greenhouse gas emissions✓/(example of greenhouse gas)
- of an individual✓ /defined population/ company per year (2)
- (b) - Food security refers to the availability and access✓
- to adequate, safe and nutritious food✓ to people at all times✓
Any (2)
- 3.2.2 - Energy used to produce and transport wasted food is lost✓
- The fossil fuels used in production and transport of wasted food✓
- and the decomposition of wasted food✓
- releases greenhouses gases ✓/examples of greenhouse gases
- leading to the enhanced greenhouse effect✓
which eventually leads to global warming (4)

| | | | |
|------------------------------|--|--|---------------------|
| 3.2.3 | <ul style="list-style-type: none"> - Buy only what is needed in sufficient quantities✓ - Give to others what is not used instead of throwing away✓ - Educate about efficient farming methods✓ - Educate about ways to preserve food✓ - Improve storage facilities✓ - Improve the shelf-life of food✓ | Any | (2) (10) |
| (Mark first TWO only) | | | |
| 3.3 | 3.3.1 | Constricted✓ | (1) |
| | 3.3.2 | <ul style="list-style-type: none"> - Less blood flows✓ to the skin - so less heat is lost to the environment✓ by radiation - Less sweat is formed✓ because less blood flows to the sweat glands - therefore less evaporation✓ of sweat - and hence less cooling✓ of the skin - Body heat is conserved✓ | Any (4) |
| | 3.3.3 | <ul style="list-style-type: none"> - Hypothalamus is stimulated✓ - sends message to the blood vessels of the skin to dilate✓/ vasodilation occurs - More blood flows✓ to the surface of the skin - More heat is lost by radiation✓ from the skin surface - More sweat is formed✓ because more blood flows to the sweat glands - and therefore more heat is lost by increased evaporation✓ of sweat | Any (4) (9) |
| 3.4 | 3.4.1 | <ul style="list-style-type: none"> - The blood glucagon levels increase✓/from 100 to 210 (picograms/ml) - from 0 to 20 min✓ - and become constant✓ thereafter | (3) |
| | 3.4.2 | <ul style="list-style-type: none"> - during exercise more energy is needed✓ - therefore the rate of cellular respiration increased✓ - Increased cellular respiration requires more glucose✓ - hence more glucagon is secreted✓ - to stimulate the conversion of glycogen to glucose✓ | Any (3) |
| | 3.4.3 | Decrease✓ | (1) |
| | 3.4.4 | <ul style="list-style-type: none"> - The lack of insulin✓/defective insulin - decreases the conversion✓ - of glucose to glycogen✓ | (3) (10) [40] |

SECTION C**QUESTION 4**

As the ball moved towards the goalkeeper:

- Accommodation✓ took place
- Ciliary muscles contracted✓
- Suspensory ligaments became slack✓
- This reduced the tension on lens✓
- Lens became more convex✓/round
- Refractive power of the lens increased✓
- Image of the ball fell on the retina✓

Any (5)

Hearing

The shout of his team-mate was heard by the goal keeper as follows:

- The sound waves were directed by the pinna✓
- through the auditory canal✓
- to the tympanic membrane✓/eardrum
- causing it to vibrate✓
- The vibrations of the tympanic membrane were transferred to the ossicles✓ in the middle ear
- which eventually caused the oval window to vibrate✓
- This set up pressure waves in the cochlea✓
- This stimulated the Organ of Corti✓ in the cochlea
- to convert this stimulus into a nerve impulse✓
- which was then transmitted along the auditory nerve✓
- and interpreted in the cerebrum✓

Any (7)

Balance and equilibrium

As he dived:

- A change in the direction and speed✓ of the body
- causes the movement of fluid in the semicircular canals✓
- which stimulates the cristae✓
- A change in the position of the head✓
- stimulated the maculae✓ in the utricle and saccule
- The stimuli were converted into impulses✓
- which were transported along the auditory nerve✓
- and interpreted in the cerebellum✓
- which then sent impulses to the muscles✓
- to restore balance and equilibrium✓

Any (5)
Content (17)
Synthesis (3)

ASSESSING THE PRESENTATION OF THE ESSAY

| Relevance | Logical sequence | Comprehensive |
|---|---|---|
| All information provided is relevant to the topic | Ideas arranged in a logical/ cause-effect sequence | Answered all aspects required by the essay |
| Only information relating to accommodation, hearing and balance & equilibrium is included. (There is no irrelevant information) | Logical sequence of events in accommodation, hearing and balance & equilibrium. | Includes sufficient information on all 3 processes, i.e. accommodation(min 3/5), hearing(min 4/7) and balance & equilibrium(min 3/5) |
| 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 2014

MARKS: 150

TIME: 2½ hours

This question paper consists of 16 pages.

INSTRUCTIONS AND INFORMATION

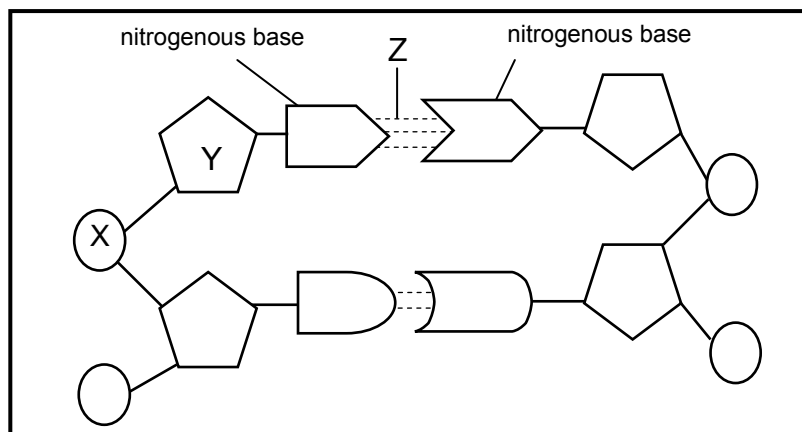
Read the following instructions carefully before answering the questions.

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. Make ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, flow charts or tables only when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. Do NOT use graph paper.
10. You must use a non-programmable calculator, protractor and a compass where necessary.
11. Write neatly and legibly.

SECTION A**QUESTION 1**

- 1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

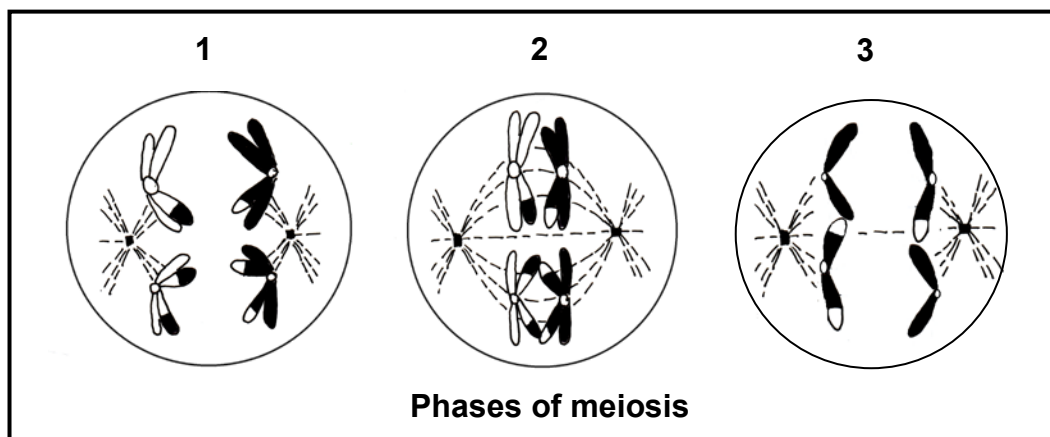
1.1.1 The diagram below shows part of a DNA molecule.



The correct labels for parts **X**, **Y** and **Z** respectively are ..

- A deoxyribose sugar, phosphate and hydrogen bond.
 - B phosphate, deoxyribose sugar and hydrogen bond.
 - C ribose sugar, nitrogenous base and peptide bond.
 - D phosphate, ribose sugar and hydrogen bond.
- 1.1.2 If 10% of the bases in a molecule of DNA are adenine, what is the ratio of adenine to guanine in the same molecule?
- A 1 : 1
 - B 4 : 1
 - C 1 : 3
 - D 1 : 4
- 1.1.3 Lamarck's 'laws' of use and disuse and inheritance of acquired characteristics were ...
- A rejected, because only characteristics that benefit offspring can be inherited.
 - B not rejected, because evidence shows that acquired characteristics can be inherited.
 - C rejected, because only characteristics that are coded for in the DNA can be inherited.
 - D not rejected, because Darwin's theory supports Lamarck's ideas.

1.1.4 The diagrams below represent different phases of meiosis.



The correct order of the phases is ...

- A 1, 2 and 3.
- B 2, 3 and 1.
- C 3, 1 and 2.
- D 2, 1 and 3.

1.1.5 Two red-eyed fruit flies were mated and they produced 150 flies with red eyes and 48 flies with white eyes. From this information we can reasonably conclude that the ...

- A white-eyed condition is recessive and both parents are heterozygous.
- B red-eyed condition is dominant and both parents are homozygous for red eyes.
- C white-eyed condition is recessive and both parents are homozygous for red eyes.
- D red-eyed condition is recessive and both parents are heterozygous.

1.1.6 Which ONE of the following monohybrid crosses will result in a phenotypic ratio of 1 : 1? A cross where ...

- A both parents are heterozygous.
- B both parents are homozygous for the dominant characteristic.
- C one parent is heterozygous and the other parent is homozygous recessive.
- D one parent is heterozygous and the other parent is homozygous dominant.

1.1.7 Study the list below.

1. Fossils
2. Homologous structures
3. Biogeography
4. Genetics

Which ONE of the combinations of the above can be used as evidence for evolution?

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

1.1.8 One reason why some people are opposed to genetic modification is that ...

- A the use of herbicides is reduced.
B crop yields are improved.
C the taste and quality of food is improved.
D the potential impact on human health is unknown.

1.1.9 Homologous chromosomes are described as ...

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

1.1.10 Four different phenotypes are possible in the F₁-generation if the parents' blood groups are ...

- A B and B.
B A and B.
C O and AB.
D AB and AB.

(10 x 2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.10) in the ANSWER BOOK.

- 1.2.1 An allele that does not influence the phenotype when found in the heterozygous condition
- 1.2.2 A section of a DNA molecule that codes for a specific characteristic
- 1.2.3 The production of a genetically identical copy of an organism using biotechnology
- 1.2.4 The manipulation of the genetic material of an organism to get desired changes
- 1.2.5 The deliberate breeding of organisms for desirable characteristics selected by humans
- 1.2.6 The explanation that species experience long periods without physical change, followed by short periods of rapid physical change
- 1.2.7 The phase of meiosis during which homologous chromosomes separate and start moving towards opposite poles
- 1.2.8 The defect in cell division that leads to Down syndrome
- 1.2.9 The structure that is made up of two chromatids joined by a centromere
- 1.2.10 An explanation for something that has been observed in nature and which can be supported by facts, laws and tested hypotheses

(10)

- 1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question number (1.3.1 to 1.3.6) in the ANSWER BOOK.

| COLUMN I | | COLUMN II | |
|----------|---|-----------|--------------------------------------|
| 1.3.1 | Discovered the shape of the DNA molecule | A: | Francis Crick |
| | | B: | James Watson |
| 1.3.2 | Each gamete receives only one allele for each characteristic | A: | Mendel's principle of segregation |
| | | B: | Darwin's theory of natural selection |
| 1.3.3 | An advantage of genetic modification | A: | Increases shelf life of food |
| | | B: | Increases resistance to disease |
| 1.3.4 | An example of a reproductive isolating mechanism | A: | Species-specific courtship behaviour |
| | | B: | Infertile offspring |
| 1.3.5 | Type of variation represented by skin colour in humans | A: | Continuous variation |
| | | B: | Discontinuous variation |
| 1.3.6 | A group of similar organisms that can interbreed to produce fertile offspring | A: | Species |
| | | B: | Genus |

(6 x 2)

(12)

- 1.4 About 70% of people get a bitter taste when a substance called PTC is placed on their tongue. They are referred to as 'tasters'. All other people are unable to taste PTC and are referred to as 'taste-blind'. The 'taster' allele is dominant and the 'taste-blind' allele is recessive.

Also in humans, normal skin pigmentation is dominant to the albino condition (no pigmentation).

The letters in the key below must be used to represent the alleles for the different characteristics above.

Key:

T – taster

t – taste-blind

N – normal skin pigmentation

n – no skin pigmentation (albino)

A man who is heterozygous for both tasting PTC and skin pigmentation marries a woman who is taste-blind for PTC and is an albino.

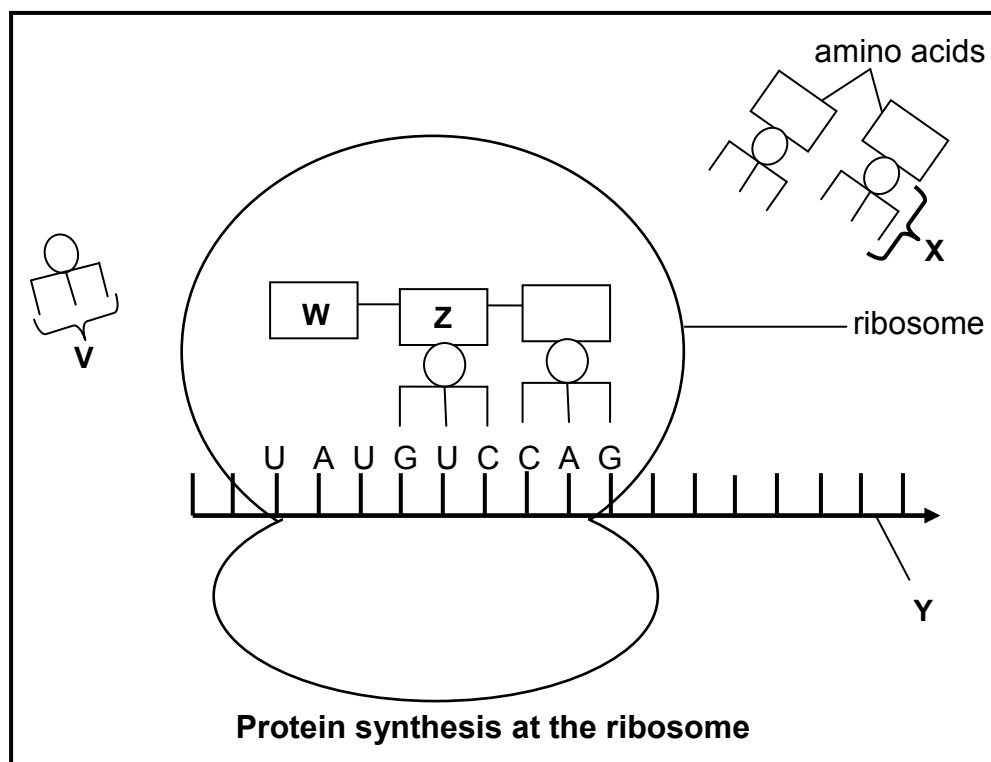
- 1.4.1 State why the example above represents a dihybrid cross. (1)
- 1.4.2 Write down:
- (a) The genotype of the woman (1)
- (b) ALL the possible gametes of the man (2)
- 1.4.3 The man and woman have a child whose genotype is **ttNn**. What is the child's phenotype? (2)
- 1.4.4 A man and a woman are only able to produce children with the genotype **TtNn**. The woman's genotype is **ttnn**. State the only possible genotype of the man. (2)

(8)

TOTAL SECTION A: 50

SECTION B**QUESTION 2**

- 2.1 Study the diagram below which shows a part of the process of protein synthesis.



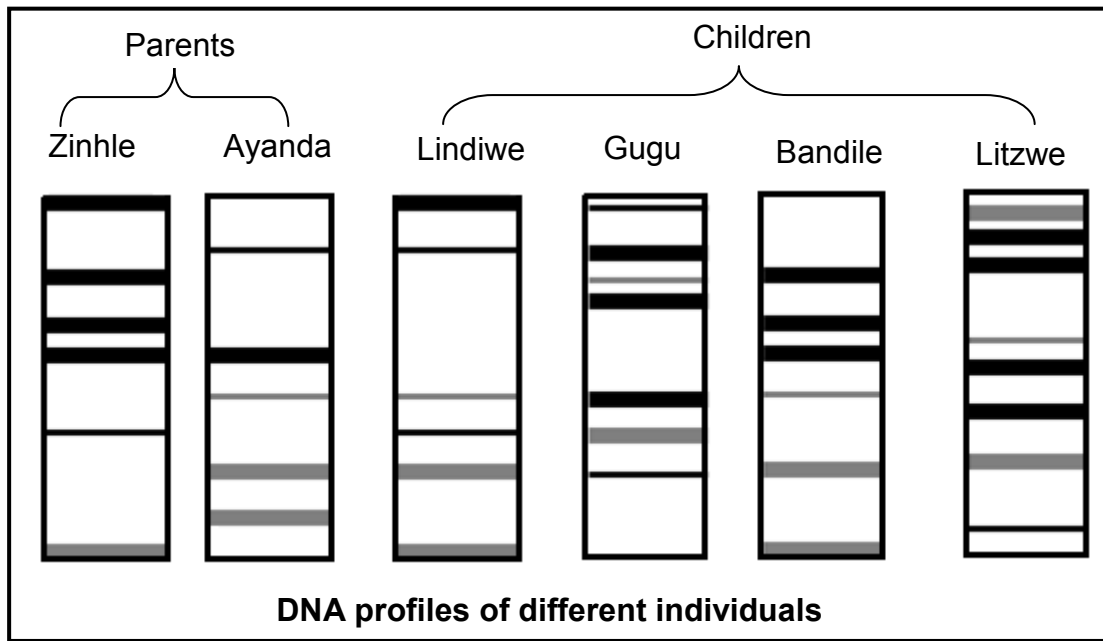
- 2.1.1 Identify the stage of protein synthesis that is shown in the diagram above. (1)
- 2.1.2 Identify molecules **X** and **Y**. (2)
- 2.1.3 State the term for the group of three nitrogenous bases indicated by **V**. (1)
- 2.1.4 Give the nitrogenous bases on the DNA strand that codes for the bases UAU on molecule **Y**. (1)
- 2.1.5 Use the table below to identify amino acid **W**.

| tRNA | Amino acid |
|------|------------|
| GUC | glutamine |
| UAA | isoleucine |
| AUA | tyrosine |
| CCC | glycine |
| GGG | proline |
| CAG | valine |

- 2.1.6 Name and describe the process that occurs in the nucleus to produce molecule **Y**. (5)
- (12)**

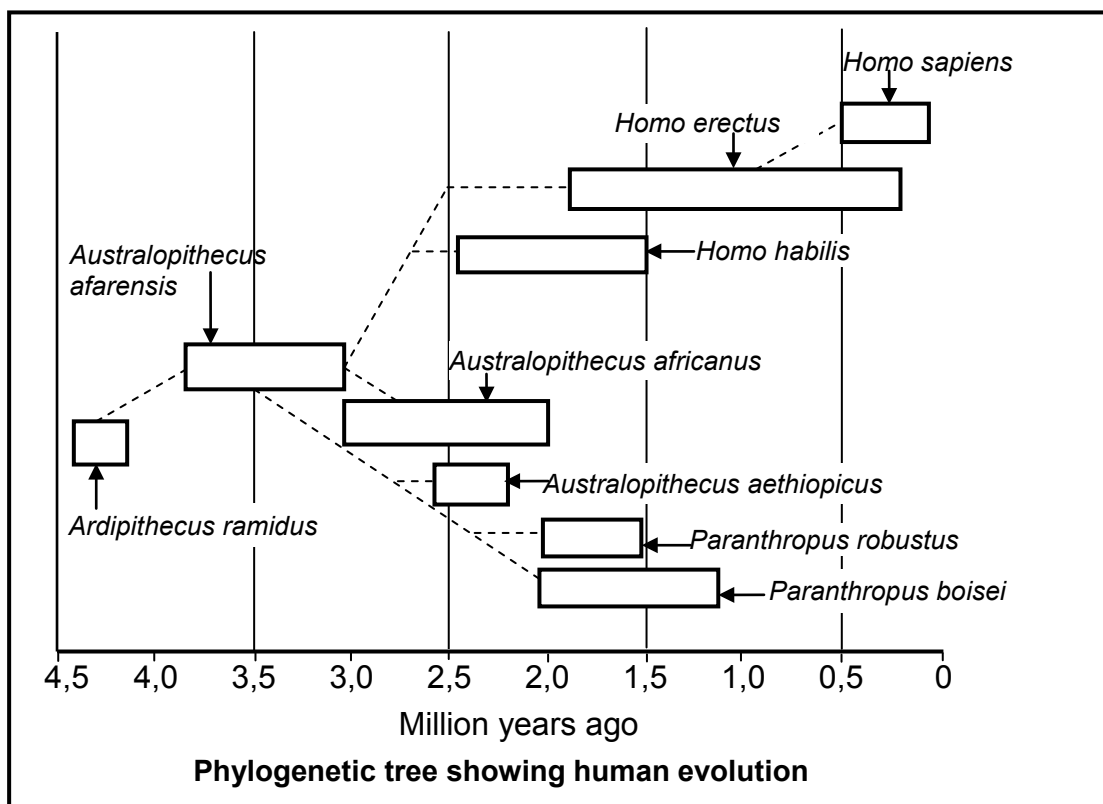
- 2.2 The diagram below shows the DNA profiles of six members of a family. The greater the similarity in the position of the bands in the DNA profiles of different individuals, the more closely they are related.

The parents, Zinhle and Ayanda, have four children. Two of the children are their biological offspring while the other two children are adopted.



- 2.2.1 Which TWO children are the biological offspring of Zinhle and Ayanda? (2)
- 2.2.2 Give an explanation for your answer to QUESTION 2.2.1 using evidence from the DNA profiles. (2)
- 2.2.3 Apart from paternity testing, state TWO ways in which DNA profiling is of use to humans. (2)
- (6)**

- 2.3 Study the phylogenetic tree below showing a possible representation of human evolution and answer the questions which follow.



[Adapted from *Biology: Understanding Life*, Sandra Alters, 1995]

- 2.3.1 According to the phylogenetic tree, which organism, *Paranthropus boisei* or *Homo habilis*, appeared first on Earth? (1)
- 2.3.2 Name TWO species whose existence on Earth overlapped with that of *Homo erectus*. (2)
- 2.3.3 Which organism was the direct ancestor of *Homo habilis*? (1)
- 2.3.4 List FIVE characteristics that are shared by all the organisms in the above phylogenetic tree. (5)
- 2.3.5 How long did *Australopithecus africanus* exist on Earth? (1)
- (10)**

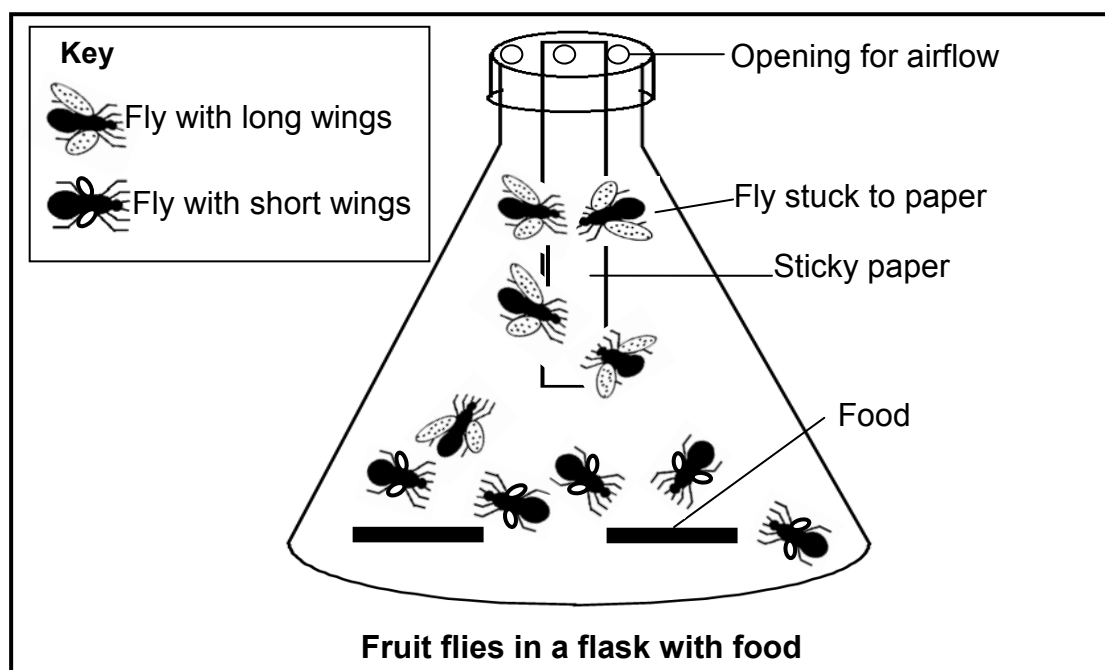
- 2.4 There is variation in the wing length of fruit flies (*Drosophila melanogaster*). Some have long wings and can fly while others have short wings and cannot fly.

An investigation was conducted to determine which flies would survive under certain conditions.

The following steps were carried out:

1. Five flies with short wings and five flies with long wings were placed in a flask.
2. Food was placed at the bottom of the flask.
3. The lid of the flask allowed airflow.
4. Sticky paper was suspended from the top of the flask. Flies that got stuck to the paper died.
5. The apparatus was left for 24 hours.

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



[Adapted from *Biology: Investigate Life on Earth* – Vernon L Avila, 1995]

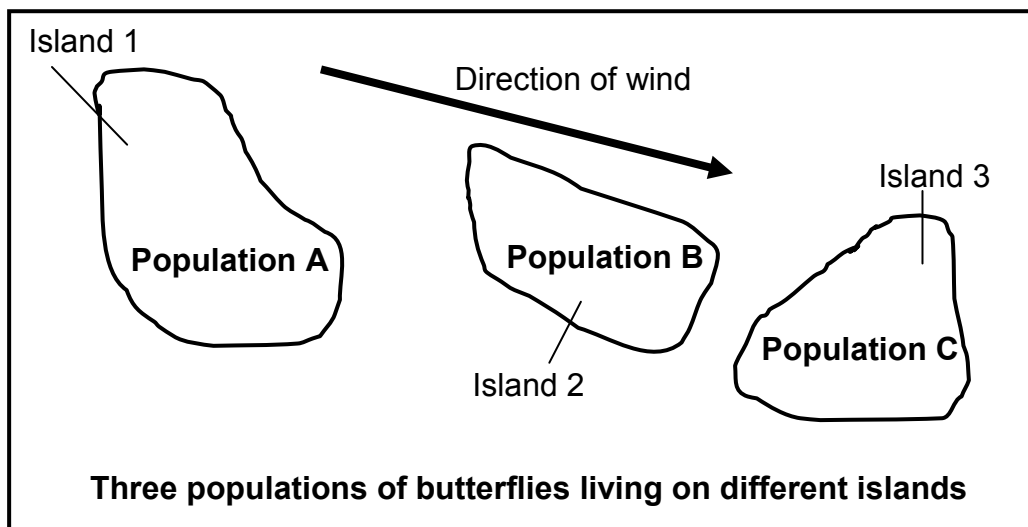
- | | | |
|-------|---|-------------|
| 2.4.1 | Formulate a hypothesis for the investigation. | (3) |
| 2.4.2 | Explain why it is necessary to have openings for airflow. | (3) |
| 2.4.3 | State TWO ways in which the reliability of the investigation could be improved. | (2) |
| 2.4.4 | Other than the opening for airflow, explain TWO other precautions that should be taken in this investigation. | (4) |
| | | (12) |
| | | [40] |

QUESTION 3

- 3.1 Three populations of butterflies, **A**, **B** and **C** live separately on three oceanic islands. The butterflies on Island 2 and Island 3 originated from Island 1.

The islands experience strong prevailing winds from the north-west throughout the year.

Populations **A** and **B** can interbreed and produce fertile offspring. Population **B** can mate with Population **C**, but the offspring are infertile. Mating does not occur between Populations **A** and **C** at all.



[Adapted from *Advanced Biology*, M Kent, 2000]

- 3.1.1 How many species are represented by the three populations? (1)
- 3.1.2 Explain your answer to QUESTION 3.1.1. (2)
- 3.1.3 Use the information provided to explain how speciation might have taken place in the above example. (5)
- (8)**

- 3.2 Study the passage on evolution below and answer the questions that follow.

The 'Out of Africa' hypothesis suggests that primitive humans migrated from Africa to all other continents of the world about 1,8 million years ago. Scientists that studied some fossilised bones of early humans that lived in Europe concluded that humans were unable to digest cow's milk before 7 000 years ago.

A mutation occurred that resulted in some individuals of the human population living in Europe being able to digest cow's milk. This ability was beneficial as it provided additional nutrients all year round. Milk is a source of vitamin D and calcium.

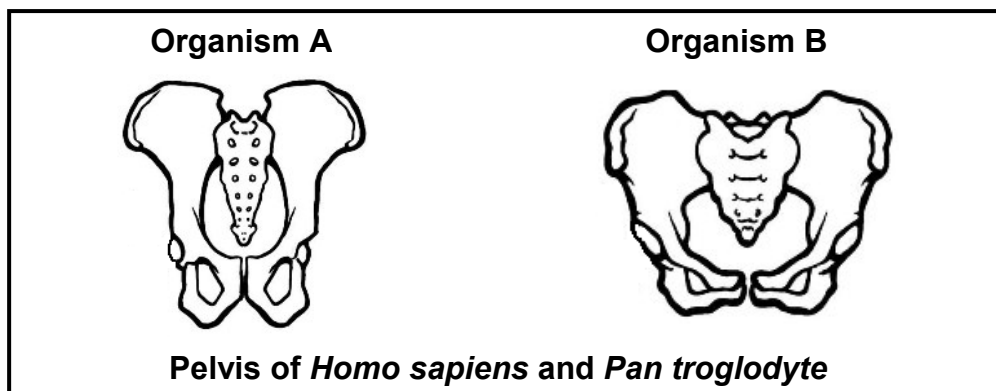
[Adapted from *Impact of Selection and Demography on the Diffusion of Lactose Persistence*. PLoS ONE 4(7) D O'Rourke, 2009]

- 3.2.1 State ONE advantage of being able to digest cows' milk to early humans that lived in Europe. (1)

3.2.2 Explain why the primitive humans that migrated out of Africa were unable to digest cows' milk. (2)

3.2.3 Apart from fossils, name ONE other type of evidence that can be used to support the 'Out of Africa' hypothesis. (1)
(4)

3.3 Study the diagrams below showing the pelvis of *Homo sapiens* and *Pan troglodyte* (chimpanzee). The diagrams are not drawn to scale.



3.3.1 Which organism, **A** or **B**, is bipedal? (1)

3.3.2 Give ONE observable reason for your answer to QUESTION 3.3.1. (2)

3.3.3 Explain TWO advantages of bipedalism. (4)
(7)

3.4 The table below shows the cranial capacities of different species of primates.

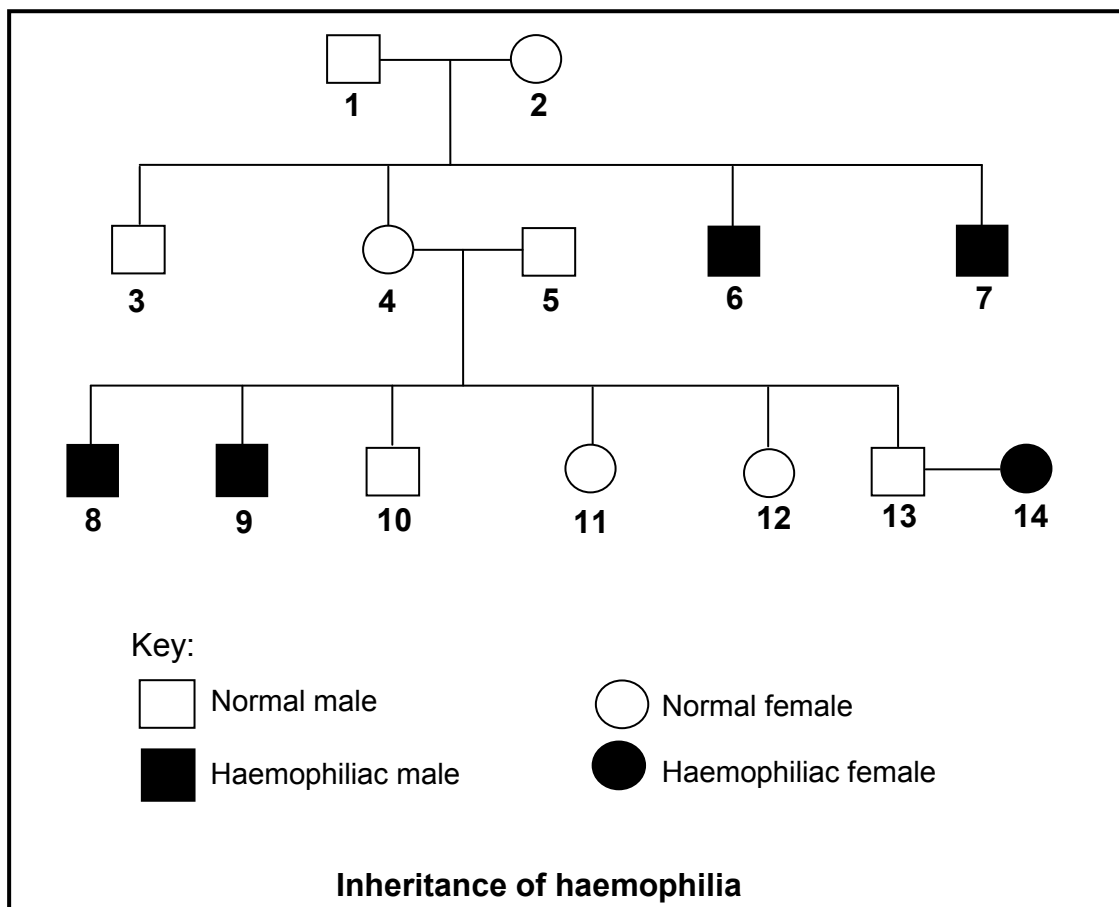
| Species | Cranial capacity (cm ³) |
|-----------------------------|-------------------------------------|
| Chimpanzee | 400 |
| Gorilla | 550 |
| <i>Australopithecus</i> sp. | 500 |
| <i>Homo habilis</i> | 650 |
| <i>Homo erectus</i> | 1 000 |
| <i>Homo sapiens</i> | 1 500 |

[Adapted from *Advanced Biology*, M Kent, 2000]

3.4.1 State TWO advantages of the large cranial capacity of *Homo sapiens*. (2)

3.4.2 Draw a bar graph to represent the data in the table. (6)
(8)

- 3.5 The pedigree diagram below shows the inheritance of haemophilia in a family. The allele causing haemophilia is represented by X^h and the normal allele is represented by X^H .



3.5.1 Determine the:

- (a) Phenotype of individual 4 (1)
 (b) Genotype of individual 2 (2)

3.5.2 Explain why females have a smaller chance of suffering from haemophilia. (3)

3.5.3 Represent a genetic cross to show the percentage chance of individuals 13 and 14 having a haemophiliac son. (7)
(13)
[40]

TOTAL SECTION B: 80

SECTION C**QUESTION 4**

Describe how meiosis and different types of mutations contribute to genetic variation and the role of this variation in natural selection.

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

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

TOTAL SECTION C: 20
GRAND TOTAL: 150



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE12

LIFE SCIENCES P2

NOVEMBER 2014

MEMORANDUM

MARKS: 150

This memorandum consists of 11 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 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-recognized abbreviations**
Accept if first defined in the 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 recognizable 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 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.
19. **Changes to the marking memorandum**
No changes must be made to the marking 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 | B✓✓ | | |
| | 1.1.2 | D✓✓ | | |
| | 1.1.3 | C✓✓ | | |
| | 1.1.4 | D✓✓ | | |
| | 1.1.5 | A✓✓ | | |
| | 1.1.6 | C✓✓ | | |
| | 1.1.7 | B✓✓ | | |
| | 1.1.8 | D✓✓ | | |
| | 1.1.9 | A✓✓ | | |
| | 1.1.10 | B✓✓ | (10 x 2) | (20) |
| 1.2 | 1.2.1 | Recessive✓ | | |
| | 1.2.2 | Gene✓ | | |
| | 1.2.3 | Cloning✓ | | |
| | 1.2.4 | Genetic engineering✓ | | |
| | 1.2.5 | Artificial selection✓ | | |
| | 1.2.6 | Punctuated equilibrium✓ | | |
| | 1.2.7 | Anaphase I✓ | | |
| | 1.2.8 | Non-disjunction✓ | | |
| | 1.2.9 | Chromosome✓ | | |
| | 1.2.10 | Theory✓ | | (10) |
| 1.3 | 1.3.1 | Both A and B✓✓ | | |
| | 1.3.2 | A only✓✓ | | |
| | 1.3.3 | Both A and B✓✓ | | |
| | 1.3.4 | Both A and B✓✓ | | |
| | 1.3.5 | A only✓✓ | | |
| | 1.3.6 | A only✓✓ | (6 x 2) | (12) |
| 1.4 | 1.4.1 | Two characteristics✓ are involved in the cross | | (1) |
| | 1.4.2 | (a) tt ⁿⁿ ✓ | | (1) |
| | | (b) T ^N ; T ⁿ ; t ^N ; t ⁿ ✓✓ | | |
| | | | 1 – 3 correct ✓ | |
| | | | all 4 correct ✓✓ | (2) |
| | 1.4.3 | Taste-blind✓ and normal skin pigmentation✓ | | (2) |
| | 1.4.4 | TTNN✓✓ | | (2) |
| | | | | (8) |
| TOTAL SECTION A: | | | | 50 |

QUESTION 2

- 2.1. 2.1.1 Translation✓ (1)
- 2.1.2 X - tRNA✓/ transfer RNA
Y - mRNA✓/ messenger RNA (2)
- 2.1.3 Anticodon✓ (1)
- 2.1.4 ATA✓ (1)
- 2.1.5 Tyrosine✓✓ (2)
- 2.1.6 - **The process is transcription**✓* (1)
- The double stranded DNA molecule unwinds✓/unzips
 - When the hydrogen bonds break✓
 - One strand is used as a template✓
 - to form mRNA ✓
 - Using free nucleotides✓ from the nucleoplasm
 - The mRNA is complementary to the DNA✓/ A-U, C-G
 - This process is controlled by enzymes✓ Any (4)
- *indicates a compulsory mark 1*** (5)
(12)
- 2.2 2.2.1 Lindiwe✓ and Bandile✓
(Mark first TWO only) (2)
- 2.2.2 They have DNA bands which correspond✓
with the banding patterns from both parents✓/ Zinhle and
Ayanda (2)
- 2.2.3 - To investigate crimes✓/ resolve disputes
- To identify organisms from their remains✓
 - To identify family relationships other than paternity✓, e.g.
siblings or cousins
 - To test for the presence of specific alleles✓/ genes that
cause a genetic disorder
 - To establish matching tissues for organ transplants✓
- (Mark first TWO only)** Any 2 (2)
(6)
- 2.3 2.3.1 *Homo habilis*✓ (1)
- 2.3.2 *Paranthropus robustus*✓, *Paranthropus boisei*✓,
Homo sapiens✓ and *Homo habilis*✓
(Mark first TWO only) Any 2 (2)
- 2.3.3 *Australopithecus afarensis*✓ (1)

CAPS– Memorandum

| | | | |
|-------|---|---|-------------|
| 2.3.4 | <ul style="list-style-type: none"> - Olfactory brain centres reduced✓/ reduced sense of smell - Eyes in front✓/ Binocular vision / stereoscopic vision - Eyes with cones✓/ colour vision - Freely rotating arms✓ - Elbow joints allowing rotation of forearm✓ - Flat nails instead of claws✓/ bare, sensitive finger tips - Opposable thumbs✓ - Bipedal✓/ upright posture / foramen magnum in a more forward position - Sexual dimorphism✓/ distinct differences between males and females - Parts of the brain that process information from the hands and eyes are enlarged✓ - Longer upper arms✓ - Large brains✓ / skulls compared to their body mass - Five digits per limb✓ | Any 5 | (5) |
| 2.3.5 | 1- 1,2 my✓/1 000 000 – 1 200 000 years | | (1) |
| | | | (10) |
| 2.4 | 2.4.1 | <ul style="list-style-type: none"> - More✓/ fewer - long-winged✓/ short-winged flies - will survive✓/ die | OR |
| | | <ul style="list-style-type: none"> - Equal numbers✓ - of both types of flies✓ - will survive✓/ die | (3) |
| | 2.4.2 | <ul style="list-style-type: none"> - CO₂ to move out and O₂ to move in✓ / ventilation - To allow respiration✓/ breathing - So that flies do not die✓/ suffocate | (3) |
| | 2.4.3 | <ul style="list-style-type: none"> - Repeat the investigation✓ - Increase the number of flies✓ - Using many flasks✓/ replications | Any 2 |
| | | (Mark first TWO only) | (2) |
| | 2.4.4 | <ul style="list-style-type: none"> - Ensure that the flies do not come into contact with the sticky paper✓ when placing them in the flask so that their death will not be caused by the investigator✓ - Ensure sufficient food supply✓ for the period of the investigation so that death of flies is not due to hunger✓ - The openings for airflow should be small✓ enough so that the flies cannot escape✓/ or others enter - Maintain optimum environmental conditions✓ to allow the flies to survive✓/ behave normally | Any 2 x 2 |
| | | (Mark first TWO only) | (4) |
| | | | (12) |
| | | | [40] |

QUESTION 3

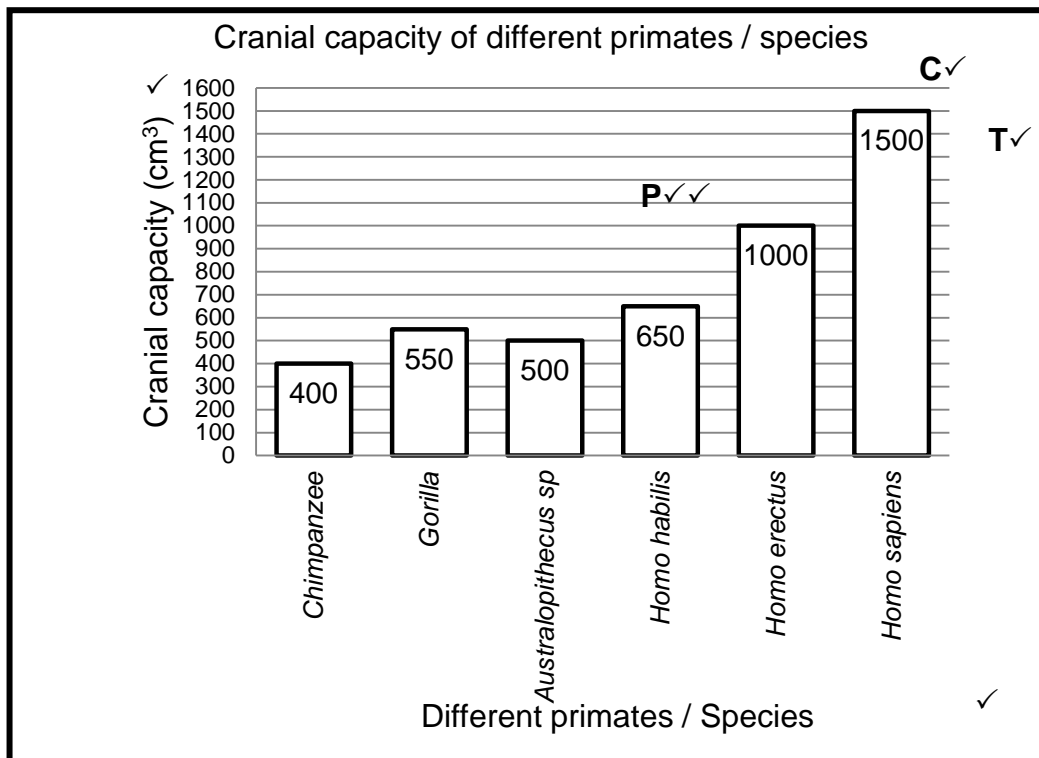
- 3.1 3.1.1 2✓ (1)
- 3.1.2 **A and B** can interbreed and produce fertile offspring, making them **one species**✓
- A** does not mate with **C**, which makes C a **different species**✓/**B** cannot produce fertile offspring with **C**, which makes C a **different species** (2)
- 3.1.3 - ***Wind blew butterflies to next island**✓ (1)
- Thus separating them geographically✓
 - As the separate islands had different environmental conditions ✓/ have different vegetation/different food for butterflies
 - each group underwent natural selection independently✓
 - and developed differently✓
 - genotypically and phenotypically✓
 - Gene flow/ reproduction between population A / B and C did not occur✓
 - resulting in a new species✓ Any (4)
- *Compulsory 1 mark** (5)
- (8)
- 3.2 3.2.1 - Provided additional nutrients✓ all year round
- Provided Vitamin D✓
 - Provided calcium✓
- (Mark first ONE only)** Any 1 (1)
- 3.2.2 - Primitive humans / *H. erectus* migrated out of Africa long before✓ the ability to digest milk evolved✓
- They did not have the mutation✓/ enzyme / gene / allele that would allow them to digest cow's milk✓
- Any 1 x 2 (2)
- 3.2.3 Mutations on mitochondrial DNA✓ (1)
- (4)
- 3.3 3.3.1 B✓ (1)
- 3.3.2 - The pelvis is shorter✓compared to its width✓
- OR**
- The pelvis is wider✓ compared to its height✓
- (Mark first ONE only)** (2)

CAPS– Memorandum

- 3.3.3 - Frees the arms✓ so that they could carry offspring✓/ tools / food / manipulate things
 - Allows ability to see further✓ to spot danger✓/ food
 - Exposes a large surface area✓ for thermoregulation✓
 - Reduces the surface area exposed to the sun✓ so less heat is absorbed✓/ less heat lost/thermoregulation
 - Expose the genitals✓to attract opposite sex✓
 - Efficient locomotion✓allows to travel longer distances✓
(Mark first TWO only) Any 2 x 2 (4)
(7)

- 3.4 3.4.1 - Allows for a bigger brain✓
 - Development of speech✓/ communication
 - Higher intelligence✓
 - Complex behaviour✓
 - Quick processing of information✓
 - Process large amounts of information✓
(Mark first TWO only) Any 2 (2)

3.4.2

**Mark allocation of the graph**

| Criterion | Elaboration | Mark |
|---------------------|---|------|
| Type of graph (T) | Bar graph drawn | 1 |
| Caption (C) | Includes both variables: 'different primates / species' and 'cranial capacity' | 1 |
| X-axis | Equal width of bars AND Correct label (different primates / species and names of species) | 1 |
| Y-axis | Appropriate scale AND Correct label and units for Y-axis (cm³) | 1 |
| Drawing of bars (P) | 1-5 bars plotted correctly – 1 mark All 6 bars plotted correctly – 2 marks | 2 |

(6)

NOTE: If axes are transposed:

- Marks will be lost for labelling of 'X-axis' and 'Y-axis'

(8)

3.5 3.5.1 (a) Normal female✓ (1)

(b) $X^H X^h$ ✓✓ (2)

- 3.5.2
- Haemophilia is caused by a recessive allele✓
 - Carried on the X chromosome✓
 - Females have two X chromosomes✓/ Males only have one X chromosome
 - Females must inherit two copies of the recessive allele✓/ females who inherit only one of the recessive allele are still normal

Any 3 (3)

3.5.3

P₁/P₃ Phenotype Normal male x Haemophiliac female✓
 Genotype $X^H Y$ x $X^h X^h$ ✓

Meiosis

G/gametes X^H, Y x X^h, X^h ✓

Fertilisation

F₁/F₃ Genotype $X^H X^h, X^H X^h, X^h Y, X^h Y$ ✓
 Phenotype 2 normal daughters : 2 haemophiliac sons✓
***50%✓ chance of having a haemophiliac son**

P₁ and F₁✓
 Meiosis and fertilisation✓

1 compulsory +any 6 (7)*OR**

P₁/P₃ Phenotype Normal male x Haemophiliac female ✓
 Genotype $X^H Y$ x $X^h X^h$ ✓

Meiosis

Fertilisation

| | | |
|---------|-----------|-----------|
| Gametes | X^h | X^h |
| X^H | $X^H X^h$ | $X^H X^h$ |
| Y | $X^h Y$ | $X^h Y$ |

1 mark for correct gametes
 1 mark for correct genotypes

F₁/F₃ Phenotype 2 normal daughters : 2 haemophiliac sons✓
***50%✓ chance of having a haemophiliac son**

P₁ and F₁✓
 Meiosis and fertilisation✓

***1 compulsory+any 6 (7)**(13)
[40]
80**TOTAL SECTION B:**

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

- Crossing over✓
- occurs during prophase I✓
- Homologous chromosomes / chromatids overlap✓
- at points called chiasma✓ / chiasmata
- Genetic material is exchanged✓
- resulting in new combinations of genetic material ✓
- Random arrangement✓ of chromosomes
- occurs during metaphase✓
- so that they separate in a random✓ / independent manner
- resulting in new combinations of genetic material✓

Max 3 (3)

Max 3 (3)

Mutations

- A gene✓ / (point and frameshift) mutation occurs
- as a result of a change in sequence of nitrogen bases✓
in the DNA molecule
- A chromosome✓ mutation occurs as a
- result of a change in the structure of a chromosome✓ /
number of chromosomes during meiosis
- Mutations that occur in sex cells✓
- are passed on to the new generations✓
- creating new characteristics✓

Max 5 (5)

Role of variation in natural selection

- Organisms of a particular species shows a great deal of variation✓
- Some individuals may have characteristics that are favourable✓
/ any example
- Others may have characteristics/any example that are unfavourable✓
- If there is competition/changing environmental conditions✓ /
Selective pressure by the environment
- organisms with favourable characteristics survive✓
- and reproduce✓
- and pass this favourable characteristics to their offspring✓
- while organisms with unfavourable characteristics will die out✓
- Over time the whole population will have this favourable trait✓

Max 6 (6)
Content: (17)
Synthesis: (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

| Criterion | Relevance (R) | Logical sequence (L) | Comprehensive (C) |
|----------------------|--|---|---|
| Generally | All information provided is relevant to the topic | Ideas are arranged in a logical sequence for each process | All aspects required by the essay have been sufficiently addressed |
| In this essay | Only information relevant to the contribution of crossing over, random arrangement of chromosomes, mutation and natural selection is given | Information regarding crossing over, random arrangement of chromosomes, mutation and natural selection arranged in logical way within each aspect | At least three correct points included on each of the three aspects: meiosis, mutations and natural selection |
| Mark | 1 | 1 | 1 |
| | R | L | C |

TOTAL SECTION C: 20
GRAND TOTAL: 150