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 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 D ✓ ✓
1.1.2 C ✓ ✓
1.1.3 C ✓ ✓
1.1.4 C ✓ ✓
1.1.5 C ✓ ✓
1.1.6 No correct answer
1.1.7 B ✓ ✓
1.1.8 D ✓ ✓
1.1.9 A ✓ ✓

(8 x 2)  (16)

1.2  
1.2.1 Ribosome ✓
1.2.2 Peptide ✓
1.2.3 Replication ✓
1.2.4 Non-disjunction ✓
1.2.5 Extinction ✓
1.2.6 Hypothesis ✓
1.2.7 tRNA ✓/transfer RNA

(7 x 1)  (7)

1.3  
1.3.1 B only ✓ ✓
1.3.2 B only ✓ ✓
1.3.3 A only ✓ ✓

(3 x 2)  (6)

1.4  
1.4.1 (a) Adenine ✓ /A
(b) Deoxyribose ✓ sugar
(c) Hydrogen bond ✓

(1)

1.4.2 10 ✓

(1)

1.4.3 - DNA has the nitrogen base thymine ✓
whereas RNA has the nitrogen base uracil ✓
(Mark first ONE only)

(2)  (6)

1.5  
1.5.1 (a) Homologous chromosomes ✓ /Bivalent
(b) Centromere ✓
(c) Chromatid ✓

(1)

1.5.2 - It holds the (two) chromatids together ✓
- Attaches the chromosome to the spindle fibres ✓ Any

(1)

1.5.3 (a) Crossing over ✓
(b) Prophase 1 ✓

(1)

1.5.4 Introduces variation ✓ /different gametes

(1)  (7)
1.6 1.6.1 (a) *Hyracotherium* ✓

(b) *Sinohippus* ✓

1.6.2 44 ✓ mya ✓ (44 – 44.5)  

1.6.3 55 ✓ /50 /46 million years ✓ /my  

TOTAL SECTION A: 48
QUESTION 2

2.1 2.1.1  (a) GgTt✓

(b) Yellow✓ leaves no thorns✓

2.1.2  GGtt✓

Ggtt✓

ggTT✓

ggTt✓

(Mark first FOUR only)

(1) (2) (4) (7)

2.2 2.2.1  Human somatic cells have 23 pairs✓/46 chromosomes and this cell has only 2 pairs✓/4 chromosomes

2.2.2  (a) 2✓

(b) 2✓

(1) (1)

2.2.3

Criteria to mark diagram

<table>
<thead>
<tr>
<th>Single cell is drawn</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only 2 unreplicated chromosomes in drawing</td>
<td>1</td>
</tr>
<tr>
<td>Short unreplicated chromosome indicating T</td>
<td>1</td>
</tr>
<tr>
<td>Long unreplicated chromosome indicating R</td>
<td>1</td>
</tr>
<tr>
<td>Any ONE correct label</td>
<td>1</td>
</tr>
</tbody>
</table>

(5) (9)

2.3  - The pair of alleles✓ on homologous chromosomes separate
- during meiosis✓/anaphase/gamete formation, so that
- only one allele of each pair is present in the gamete✓/offspring can acquire one allele from each parent

(3)
2.4 2.4.1 (a) Suffers from Huntington's\(^v\) chorea (1)

(b) hh\(^v\) (1)

2.4.2 hh\(^v\) (1)

2.4.3 - Emma's genotype is Hh\(^v\)/heterozygous (3)
- The father's genotype has to be hh\(^v\)/homozygous recessive (3)
- a cross between only these two genotypes\(^v\)/(Hh and hh) will ensure that there is 50\% chance of the child not inheriting the disease (3)
- The child inherits one recessive allele from each parent\(^v\) (6)

2.5.1 Transcription\(^v\) (1)

2.5.2 Nucleus\(^v\)/nucleoplasm (1)

2.5.3 (a) GTC\(^v\) (1)

(b) UAC\(^v\) (1)

2.5.4 Valine\(^v\) (2)

2.5.5 - A mutation affects the nucleotide sequence\(^v\)/nitrogen base sequence/gene structure (3)
- Resulting in a changed mRNA\(^v\)/codon (3)
- A different amino acid\(^v\) may be coded for (3)
- by tRNA\(^v\)/anticodon Any 3 (9)
2.6  2.6.1

\[ \begin{align*}
P_1 & \quad \text{Phenotype} \quad \text{Pink} \times \text{Pink}^\checkmark \\
& \quad \text{Genotype} \quad \text{RW} \times \text{RW}^\checkmark \\
\text{Meiosis} & \quad \text{G/gametes} \quad \text{R, W} \times \text{R, W}^\checkmark \\
\text{Fertilisation} & \quad \text{F}_1 \quad \text{Genotype} \quad \text{RR; RW; RW; WW}^\checkmark \\
& \quad \text{Phenotype} \quad \text{Red} : \text{Pink} : \text{White}^\checkmark \\
\end{align*} \]

\[ \text{P}_1 \text{ and F}_1^\checkmark \]
\[ \text{Meiosis and fertilisation}^\checkmark \]

\[ \text{Any 6} \]

\[ \text{OR} \]

\[ \begin{align*}
P_1 & \quad \text{Phenotype} \quad \text{Pink} \times \text{Pink}^\checkmark \\
& \quad \text{Genotype} \quad \text{RW} \times \text{RW}^\checkmark \\
\text{Meiosis} & \quad \text{Gametes} \quad \begin{array}{ccc}
\text{R} & \text{RR} & \text{RW} \\
\text{W} & \text{RW} & \text{WW}
\end{array} \\
\text{Fertilisation} & \quad \text{F}_1 \quad \text{Phenotype} \quad \text{Red} : \text{Pink} : \text{White}^\checkmark \\
\end{align*} \]

\[ 1 \text{ mark for correct gametes} \]
\[ 1 \text{ mark for correct genotypes} \]

\[ \text{F}_1 \text{ and} \]
\[ \text{Meiosis and fertilisation}^\checkmark \]

\[ \text{Any 6} \]

[40]
QUESTION 3

3.1 3.1.1 With the discovery that the soil bacterium *Agrobacterium* could be used to transfer useful genes from unrelated species into plants

- Modified crops may become super-weeds / accidentally breed with other plants to become super-weeds
- They are difficult / expensive to kill
- and could outcompete the original crop / other crops Any

3.1.2 - Toxic proteins might be produced
- Antibiotic-resistance genes may be transferred to human gut bacteria
  (Mark first TWO only)

3.1.3 - Modified crops may become super-weeds / accidentally breed
- They are difficult / expensive to kill
- and could outcompete the original crop / other crops Any

3.2 3.2.1 (a) colour of lizard
(b) survival rate of the lizards

3.2.2 - It decreases survival / lizards may die / is harmful / is lethal to the red lizards as
- they will be seen on the black rock by the predators
OR
- They could not escape predators / catch prey on cold days
- as red lizards did not warm up fast on cold days Any 1 x 2

3.2.3 - To allow enough time for reproduction and survival to be able to calculate the percentage to ensure reliability of results
OR
- A change in population proportions will not be seen over a shorter time period to ensure reliability of results Any 1 x 2

3.2.4 - Conduct the investigation in the same habitat / environment
- Use the same sampling technique
- Capture the same number of lizards in each sampled generation
- Take each sample at the same time of day / weather conditions (Mark first TWO only) Any 2

3.2.5 - There is variation in colour amongst the lizards
  *Red and brown lizards*
- *are not camouflaged / cannot warm up fast enough to have energy to run away
- are killed by predators
- *The black lizards*
- *are better camouflaged / warm up faster to have energy to avoid predators
- and survive / reproduce
- The allele for black colour is passed on to the next generation
- to produce more black lizards in the next generation

Any 2+*4 compulsory marks
3.2.6

Guideline for the assessing the graph

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar graph for the required data</td>
<td>1</td>
</tr>
<tr>
<td>Title of graph</td>
<td>1</td>
</tr>
<tr>
<td>Correct label and scale for X-axis</td>
<td>1</td>
</tr>
<tr>
<td>Correct label and scale for Y-axis</td>
<td>1</td>
</tr>
</tbody>
</table>
| Drawing of bars         | 1: 1 to 3 bars plotted correctly  
                          | 2: All 4 bars plotted correctly |

NOTE:
If the wrong type of graph is drawn, marks will be lost for:
- 'Bar graph'
- 'Drawing of bars'
If two graphs are drawn mark the first ONE only
3.3 - The common ancestor/original camel population
- was separated/due to continental drift
- into different populations
- by the sea/due to continental drift
- There was no gene flow between the populations
- Each population was exposed to different environmental conditions
- Natural selection occurred independently in each population
- The individuals of each population became different from each other over time
- genotypically and phenotypically
- Even if the three populations were to mix again
- they would not be able to interbreed

Any 5+1 compulsory (6)

3.4 3.4.1 A, B, i
3.4.2 2
3.4.3 - Any individual inherits one allele from each parent
3.4.4 - Each child
- has an equal/25% chance of having
- any blood group A, B, AB, or O.

(3) (9) [40]
SECTION C

QUESTION 4

HYPOTHESIS
- All modern humans / Homo sapiens originated in Africa and migrated to other parts of the world

2*(compulsory) +1 (3)

FOSSIL EVIDENCE ✓
- Fossils of Ardipithecus were found ONLY in Africa / Rift Valley/Ethiopia/South Africa
- Fossils of Australopithecus were found ONLY in Africa / Rift Valley/Ethiopia/South Africa
- The fossils of Homo habilis were ONLY found in Africa ✓
- The OLDEST fossils of Homo erectus were found in Africa ✓
- The OLDEST fossils of Homo sapiens were found in Africa ✓ Max (4)

GENETIC EVIDENCE ✓
- Mitochondrial DNA ✓
- Is inherited only from the maternal line ✓
- Analysis of mutations ✓ on this mitochondrial DNA
- shows that the oldest female ancestor were located in Africa ✓
- and that all humans descended from her / mitochondrial Eve
- The Y chromosome shows the paternal line ✓ Max (4)

CULTURAL EVIDENCE ✓
- The OLDEST / most primitive artefacts (tools, cutlery, art etc.)
- were found in Africa ✓ (2)

TOTAL FOR EVIDENCE (8)

BIPEDALISM
The fossils of all three genera indicate that:
- The foramen magnum ✓
- is located in a more forward position ✓

- The pelvis ✓
- is wider and shorter ✓

- The spine ✓
- is S-shaped ✓

(6)

Content (17)
Synthesis (3)

ASSESSING THE PRESENTATION OF THE ESSAY

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Relevance (R)</th>
<th>Logical sequence (L)</th>
<th>Comprehensive (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generally</td>
<td>All information provided is relevant to the question.</td>
<td>Ideas are arranged in a logical sequence.</td>
<td>All aspects of the essay have been sufficiently addressed.</td>
</tr>
<tr>
<td>In this essay in Q4</td>
<td>Only information relevant to the 'Out of Africa' hypothesis and bipedal fossils of the three genera are described. No irrelevant information included.</td>
<td>The description of the evidence for the 'Out of Africa' hypothesis and the evidence of bipedalism is presented in a logical and sequential manner.</td>
<td>At least the following marks should be obtained: - 7/11 for the 'Out of Africa' hypothesis and the evidence of bipedalism is presented in a logical and sequential manner. - 4/6 on evidence for bipedalism.</td>
</tr>
</tbody>
</table>

Mark 1 1 1

TOTAL SECTION C: 20
GRAND TOTAL: 150

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