LIFE SCIENCES P2
EXEMPLAR 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 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 | B✓✓ |  
|     | 1.1.3 | A✓✓ |  
|     | 1.1.4 | A✓✓ |  
|     | 1.1.5 | D✓✓ |  
|     | 1.1.6 | C✓✓ |  
|     | 1.1.7 | D✓✓ |  
|     | 1.1.8 | B✓✓ |  
|     | 1.1.9 | B✓✓ |  
|     | 1.1.10| B✓✓ |  

(10 x 2) (20)

1.2 | 1.2.1 | Recessive✓ |  
|     | 1.2.2 | Locus✓ |  
|     | 1.2.3 | Phenotype✓ |  
|     | 1.2.4 | Autosomes✓ |  
|     | 1.2.5 | Genetic engineering✓/DNA manipulation/Biotechnology/DNA recombination |  
|     | 1.2.6 | Chromatids✓ |  

(6 x 1) (6)

1.3 | 1.3.1 | Both A and B✓✓ |  
|     | 1.3.2 | A only✓✓ |  
|     | 1.3.3 | B only✓✓ |  
|     | 1.3.4 | A only✓✓ |  
|     | 1.3.5 | B only✓✓ |  
|     | 1.3.6 | A only✓✓ |  
|     | 1.3.7 | None✓✓ |  
|     | 1.3.8 | B only✓✓ |  

(8 x 2) (16)

1.4 | 1.4.1 | (a) RrYy✓ |  
|     |       | (b) rryy✓ |  
|     |       |  
|     | 1.4.2 | RY, Ry, rY, ry✓✓ |  
|     | 1.4.3 | (a) Wrinkled, yellow✓ seeds |  
|     |       | (b) Round, yellow✓ seeds |  
|     | 1.4.4 | RRYY✓✓ |  

(1) (1) (2) (1) (1) (2) [8] [50]
QUESTION 2

2.1 2.1.1 (a) DNA✓
(b) Ribosome✓

2.1.2 (a) G✓
(b) U✓

2.1.3 – DNA codes for a particular protein✓ but cannot leave nucleus
– One strand of DNA is used as a template✓ to form mRNA✓

2.1.4 – According to the codons on mRNA✓
– tRNA molecules with matching anticodons✓
– bring the required amino acids to the ribosome✓
– This is called translation✓
– The amino acids become attached by peptide bonds✓
– to form the required protein✓

2.1.5 Methionine, ✓ Glycine, ✓ Arginine✓ (in the correct order)

2.2 2.2.1 *H. erectus*✓

2.2.2 *A. afarensis*✓

2.2.3 (a) 3 mya – 2,4✓ mya = 0,6✓ my✓
OR
3 mya – 2,3✓ mya = 0,7✓ my✓

(b) Fossils✓

2.2.4 (a) *H. neanderthalensis*✓

(b) *H. neanderthalensis* and *H. sapiens* share a common✓ ancestor✓
OR
Both evolved✓ from *H heidelbergensis*✓
2.3 2.3.1 - The homologous chromosome pair ✓
- does not separate ✓ / non-disjunction
- during anaphase 1 ✓

2.3.2 1 ✓

2.3.3 Down syndrome ✓

2.3.4 - During crossing over ✓
  - in Prophase 1 ✓
  - segments of chromatids of homologous chromosomes ✓
  - are exchanged ✓
  - leading to each gamete having a mix of genetic material from both parents ✓

- During Metaphase I ✓ / II
  - each pair of homologous chromosomes ✓ / each chromosome
  - may line up in different ways ✓ on the equator of the spindle
  - allowing the gametes to have different combinations of maternal and paternal chromosomes ✓

2.4 2.4.1 Diagram 1 ✓

2.4.2 Diagrams 2 & 3 ✓ / 2 & 4 / 3 & 4

2.4.3 Analogous structures show that two organisms evolved independently of each other ✓
Homologous structures show that two organisms have a common ancestor ✓.
QUESTION 3

3.1 3.1.1  (a) Time ✓  

(b) Mortality of mosquitoes ✓  

3.1.2 Mosquito Mortality due to DDT ✓/Resistance of mosquitos to DDT will decrease ✓ over time ✓  

OR  

Mosquito Mortality due to DDT ✓/Resistance of mosquitos to DDT will increase ✓ over time ✓  

OR  

Mosquito Mortality due to DDT ✓/Resistance of mosquitos to DDT will remain the same ✓ over time ✓  

3.1.3

NOTE:
If the wrong type of graph is drawn:
- Marks will be lost for 'correct type of graph'
If axes are transposed:
- Marks will be lost for labelling of X-axis and Y-axis
Mark allocation for the graph

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Elaboration</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of graph</td>
<td>Line graph drawn</td>
<td>1</td>
</tr>
<tr>
<td>Caption</td>
<td>Includes both variables: 'Percentage mortality of mosquitoes' and 'Time'</td>
<td>1</td>
</tr>
<tr>
<td>X-axis</td>
<td>Appropriate scale AND Correct label and units for X-axis: Time (months)</td>
<td>1</td>
</tr>
<tr>
<td>Y-axis</td>
<td>Appropriate scale AND Correct label and units for Y-axis: Mortality of mosquitoes (%)</td>
<td>1</td>
</tr>
<tr>
<td>Plotting of points</td>
<td>1–8 points plotted correctly – 1 mark</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>All 9 points plotted correctly – 2 marks</td>
<td></td>
</tr>
</tbody>
</table>

3.1.4
- Same species of mosquito
- Identical laboratory conditions for the full period of the investigation
- The same scientist must be used for the full period of the investigation
- Mosquitos should not be hurt for the full period of the investigation
  (Mark first TWO only) (any 2) (2)

3.1.5
- Use a larger sample of mosquitoes
- Repeat the investigation
- Take many samples each time and calculate the average mortality
  (Mark first TWO only) (any 2) (2)

3.1.6
- More mosquitoes are produced than can survive.
- There is genetic variation amongst the mosquitoes.
- Some mosquitoes may be naturally resistant to DDT.
- When DDT is applied
  - those that are resistant survive
  - and they then reproduce
  - passing the allele for resistance to the offspring
- Those that are not resistant, die
  - and their alleles are lost from the population
- The number of DDT-resistant mosquitoes therefore increases over the generations.
  (any 8) (23)

3.2
3.2.1
The oldest fossils of human ancestors were only found in Africa (2)

3.2.2
- Mitochondrial DNA is passed down from mother to child
- mutations on the mitochondrial DNA
- were traced to an ancestral female that existed in Africa (3) (5)
3.3  3.3.1
(a) \( X^dX^d \)  
(2)
(b) \( X^DY \)  
(2)

3.3.2  3
(2)

3.3.3  \( P_1 \)

<table>
<thead>
<tr>
<th>Phenotype</th>
<th>Genotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal female</td>
<td>( X^Dx^d )</td>
</tr>
<tr>
<td>Normal male</td>
<td>( X^DY )</td>
</tr>
</tbody>
</table>

**Meiosis**

\( G_1 \)

<table>
<thead>
<tr>
<th>Gametes</th>
<th>Genotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td>( X^D ), ( X^d )</td>
<td>( X^Dx^d ), ( X^Dx^d ), ( X^Dx^d )</td>
</tr>
</tbody>
</table>

**Fertilisation**

\( F_1 \)

<table>
<thead>
<tr>
<th>Genotypes</th>
<th>Phenotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 normal females</td>
<td>1 normal male, 1 colour-blind male</td>
</tr>
</tbody>
</table>

Parents and offspring\( \checkmark / P_1 \) & \( F_1 \)
Meiosis and fertilisation\( \checkmark \)

**OR**

\( P_1 \)/parent phenotype

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Gametes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey bodied x grey bodied</td>
<td>( Gg ) x ( Gg )</td>
</tr>
</tbody>
</table>

**Meiosis**

<table>
<thead>
<tr>
<th>Gametes</th>
<th>Genotypes</th>
</tr>
</thead>
<tbody>
<tr>
<td>( X^D ), ( X^d )</td>
<td>( X^Dx^d ), ( X^Dx^d ), ( X^Dx^d )</td>
</tr>
</tbody>
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**Fertilisation**

\( F_1 \)

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Parents and offspring\( \checkmark / P_1 \) & \( F_1 \)
Meiosis and fertilisation\( \checkmark \)

\[40\]

\(80\)
SECTION C

QUESTION 4

The development of a new species

- If a population splits into two populations.
- There is now no gene flow between the two populations.
- Since each population may be exposed to different environmental conditions,
- Natural selection occurs independently in each of the two populations
- such that the individuals of the two populations become very different from each other
- genotypically and phenotypically.
- Even if the two populations were to mix again,
- they will not be able to reproduce with each other, thus becoming different species

The development of bipedalism

- The backward position of the foramen magnum on the skull,
- the narrow pelvis
- and the less-curved spine
- indicates that the ape-like beings were quadripedal

The forward position of the foramen magnum on the skull,
- the wider pelvis
- and the curved spine
- indicates that modern humans are bipedal

Change in the diet from raw food to cooked food

- The large teeth, especially the canines
- as well as the large and long jaws
- which makes the skull prognathous
- as well as cranial/brow ridges associated with large muscles that operate the jaws
- indicate that the ape-like beings ate raw food that required a great amount of processing/tearing, biting and chewing.

- The smaller teeth, including the canines
- as well as the smaller jaw size
- which makes the skull less prognathous
- as well as the absence of cranial/brow ridges due to the presence of smaller muscles for chewing
- indicate that modern humans rely on a diet of cooked food that does not require the same amount of processing/tearing, biting and chewing.
# ASSESSING THE PRESENTATION OF THE ESSAY

<table>
<thead>
<tr>
<th>Relevance</th>
<th>Logical sequence</th>
<th>Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only information regarding development of a new species, the development of bipedalism and change in diet is given (no irrelevant information).</td>
<td>Generally, the development of a new species, the development of bipedalism and change in diet are explained logically.</td>
<td>All three aspects of the question are described correctly.</td>
</tr>
</tbody>
</table>

TOTAL SECTION C: 20  
GRAND TOTAL: 150