Education and Sport Development

Department of Education and Sport Development
Departement van Onderwys en Sportontwikkeling
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NORTH WEST PROVINCE

NATIONAL SENIOR CERTIFICATE

GRADE 12

LIFE SCIENCES P2

SEPTEMBER 2017

MEMORANDUM

MARKS: 150

This memorandum consists of 13 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 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, sketches, 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.

SECTION A

QUESTION 1

1.1.1 D✓✓

1.1.2 A✓✓

1.1.3 D✓✓

1.1.4 A✓✓

1.1.5 C✓✓

1.1.6 D✓✓

1.1.7 B✓✓

1.1.8 B✓✓

1.1.9 B✓✓

1.1.10 C✓✓ (10 x 2) **(20)**

1.2.1 mtDNA / Mitochondrial DNA✓

1.2.2 Phylogenetic tree✓

1.2.3 Extinct✓

1.2.4 Foramen magnum✓

1.2.5 Hydrogen bond ✓/H-bond/H^+

1.2.6 Lamarck✓

1.2.7 Opposable thumb✓

1.2.8 Bipedal✓ (8 x 1) **(8)**

1.3.1 None✓✓ (2)

1.3.2 A only✓✓ (2)
(4)

1.4.1 *H. erectus*✓ (1)

1.4.2 *H. neanderthalensis*✓; *H heidelbergensis*✓; *H. erectus*✓ (3)
(MARK FIRST THREE ONLY)

1.4.3 1,8✓ mya✓ (2)

1.4.4 *A. sediba*✓; *A. africanus*✓ (2)
(MARK FIRST TWO ONLY)

1.4.5 *Australopithecus*✓; *Ardipithecus*✓ (2)
(MARK FIRST TWO ONLY) **(10)**

1.5.1 The **number of black and brown offspring**✓
from **4 crosses**✓ between a breeding pair of mice/ black male and brown female (2)

1.5.2 Number of black and brown offspring✓ (1)

1.5.3 Black : Brown
24 : 8✓
3 : 1✓ (2)

1.5.4 The black male is heterozygous✓
and the brown female is homozygous✓ (2)

1.5.5 To increase the reliability✓ of the investigation (1)
(8)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1.1 HMS Beagle✓/Beagle (1)

2.1.2

- During the last ice age a group of wolves crossed from the mainland of South America to the Falkland Islands on a narrow ice bridge✓
- After the ice melted, the wolfs on the island were separated✓ from the mainland wolves by
- a geographic barrier ✓/ the ocean
- There was no gene flow✓ between the two populations
- The environment on the islands was different✓from the mainland
- Natural selection occurred independently✓ in the two populations
- such that the two populations became very different✓
- genotypically and phenotypically✓
- Even if the two populations were to mix again, they will not be able to reproduce✓

Any 5 (5)

2.1.3

(a)
- There was variation✓ among the wolf population
- Some had short legs✓
- and some had long legs✓
- The environment changed✓ to one with very tall grass
- The wolves with short legs could not find prey and died✓
- The wolfs with long legs could find prey easier✓ and survived✓
- The wolves with long legs reproduced✓
- and passed on the gene for long legs to their offspring✓
- A higher proportion of the offspring had the favourable characteristic of long legs✓

Any 7 (7)

(b)
- The reddish fur with black legs✓ helped with camouflage✓ in the tall grass environment
- The ability to rotate their ears✓ helped them to locate prey✓/detect predators in the tall grass environment

Any (1 x 2) (2)

(MARK FIRST ONE ONLY) **(15)**

2.2.1 Gene✓ mutation (1)

2.2.2 - In a gene mutation a single base is changed/deleted/added✓
- In a chromosome mutation the structure of a chromosome✓ is changed or
- the number of chromosomes change✓ (3)

2.2.3 TCC✓changed to TCT✓ (2)

2.2.4 Isoleucine – Serine – Methionine – Proline✓✓ (2)
(ALL FOUR MUST BE CORRECT)

2.2.5

P_1: Phenotype Normal X Normal✓
Genotype Tt X Tt✓
Meiosis
Gametes: T; t T; t✓
Fertilisation
F_1:

Gametes	T	t
T	TT	Tt
t	Tt	tt

✓

Phenotype: 25% chance to have a child with Tay Sachs ✓

Both P_1 and F_1 ✓
Both meiosis and fertilisation ✓ (Any 6)

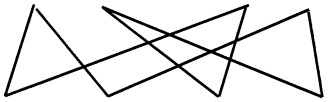
OR

P_1:	Phenotype	Normal	X	Normal✓
	Genotype	Tt	X	Tt✓

Meiosis

Gametes **T t T t** ✓

Fertilisation



F_1: **T T Tt Tt tt** ✓

Phenotype: 25% chance to have a child with Tay Sachs ✓

Both P_1 and F_1 ✓
Both meiosis and fertilisation ✓ (Any 6)

2.2.6 $\frac{1}{27}$ ✓X $\frac{360\,000}{1}$ ✓= 13✓ **OR** $\frac{360\,000}{27}$ ✓✓= 13✓ (3)

(17)

2.3.1 - Organisms of which the DNA/ genetic material have been changed✓
by inserting a gene from another organism✓ (2)

2.3.2 - Long term effect of modified organisms on the environment is not known✓
- They may have a negative effect on the environment in future✓
- The modified mosquitoes/Zika virus may evolve✓
and also spread the disease in future✓
- Moral/ethical objections✓
- People should not interfere with nature✓
(MARK FIRST TWO ONLY) Any (2 x 2) (4)

2.3.3 - The island is isolated from the mainland✓
- If anything goes wrong, the mosquitoes can be controlled more easily✓
on a small island
- and they won't spread to the mainland✓ Any 2 (2)

(8)

[40]

QUESTION 3

3.1.1 - Humans eat softer/ cooked food✓
and therefore need smaller teeth✓
- Chimpanzees ate raw/uncooked food✓
and therefore needed larger and stronger teeth✓ (4)

3.1.2 T=✓

Chimpanzee	Human
More prognathous/ slanting face✓	Less prognathous/Flatter face✓
Heavy brow ridges✓	Smaller brow ridges✓
Smaller cranium✓	Larger cranium✓

(Table 1 + 3 x 2) (7)

3.1.3 - They have binocular vision✓
- and therefore see one image✓
- They have stereoscopic vision✓
- to judge distance✓/depth Any 3 (3)

(MARK FIRST THREE ONLY) **(14)**

3.2.1 B; D; C; A✓ (1)

(ALL FOUR MUST BE IN CORRECT SEQUENCE)

3.2.2 - Homologous chromosome pairs arrange on the equator✓ in diagram D
- The two chromosomes of a homologous pair move to opposite poles✓ in diagram C
- The chromosome number is halved✓ Any 2 (2)

(MARK FIRST TWO ONLY)

3.2.3 Two✓/2 (1)

3.2.4 - The homologous chromosomes✓
- arrange together✓/form pairs/bivalents
- one chromatid of each pair cross over✓ / overlap
- Chiasmata✓ form between the chromatids of the homologous chromosomes
- Genetic material is exchanged✓ between the homologous chromosomes
- Each homologue now contains both maternal and paternal genes✓ Any 5 (5)

3.2.5 - Non-disjunction✓
- of chromosome pair 21✓ takes place
- Both chromosomes of pair 21 move to the same pole ✓
- The gamete that will form will have one extra copy of chromosome 21✓
- If this gamete fuses with a normal gamete✓
- it will result in a zygote with 3 copies of chromosome 21✓
- This is called trisomy 21✓ Any 5 (5)

(14)

3.3 - During transcription✓ an mRNA molecule is formed that is
- complementary to the DNA✓
- The mRNA leaves the nucleus and attaches to a ribosome✓
- During translation✓
- tRNA molecules attach to specific amino acids✓
- in the cytoplasm✓
- according to their specific anti-codons✓
- tRNA transfer the amino acids to the ribosome✓
- where tRNA anti-codons attach to complementary codons✓
- placing the amino acids in a specific order✓in the protein Any 8 **(8)**

3.4 - Breeding during different times of the year✓
- Species-specific courtship behaviour✓
- Adaptation to different pollinators✓
- Infertile offspring✓ / hybrid infertility
(MARK FIRST FOUR ONLY) **(4)**
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

How alleles determine blood groups:

- Human blood groups are determined by multiple alleles✓
- I^A✓; I^B✓ and i✓
- I^A and I^B are co-dominant ✓
- i is recessive✓
- Blood group A can have the genotypes I^AI^A✓
- or I^Ai✓
- Blood group B can have the genotypes I^BI^B ✓
- or I^Bi✓
- Blood group AB has the genotype I^AI^B✓
- Blood group O has the genotype ii✓ Any 9

How blood typing is used to solve paternity cases

- The blood groups of the father, mother and child must be compared✓
- If it proves that it is not possible✓ for the man and woman to have a child with the specific blood group
- the man is not the father✓
- If it shows that the man and the woman can possibly✓ have a child with that specific blood group
- DNA profiling✓
- needs to be done to confirm that he is the father or not✓ Any 4

Why and how DNA profiling can be used to confirm paternity

- The DNA profiles of the possible father and child must be compared✓
- A child receives 50%/half of his/her DNA from his/her father✓
- If half/50% of the dark bands on the DNA profile of the child correlate with that of the possible father✓
- the man is the father of the child✓
- If there is no/little correlation between the DNA of the child and the possible father✓
- the man is not the father of the child✓

Any 4
Content: (17)

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 sequence	All aspects of the essay have been sufficiently addressed
In this essay: Question 4	Only information relevant to blood groups and blood typing and DNA profiling with regard to paternity cases are described No irrelevant information included	All three aspects are presented in a logical and sequential manner	Minimum mark of: Blood groups – 7/9 Blood typing – 2/4 DNA profiling – 2/4
Mark	1	1	1

Synthesis: (3)

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES PAPER 2: QUESTION ANALYSIS GRID

SECTION A	Cognitive Levels								
Question 1	A	B	C	D	CONTENT				
	Basic knowledge	Comprehension	Application	Analysis, Synthesis & Evaluation	DNA: Code of Life	Meiosis	Genetics and Inheritance	Evolution	Total Question 1 (50)
1.1.1	2				2				
1.1.2	2							2	
1.1.3		2					2		
1.1.4	2							2	
1.1.5	2							2	
1.1.6		2						2	
1.1.7		2					2		
1.1.8	2				2				
1.1.9				2				2	
1.1.10	2							2	
									20
1.2.1	1							1	
1.2.2	1							1	
1.2.3	1							1	
1.2.4	1							1	
1.2.5	1				1				
1.2.6	1							1	
1.2.7	1							1	
1.2.8	1							1	8
1.3.1		2						2	
1.3.2		2						2	4
1.4.1		1						1	
1.4.2		3						3	
1.4.3		2						2	
1.4.4	2							2	
1.4.5		2						2	10
1.5.1			2				2		
1.5.2		1					1		
1.5.3		2					2		
1.5.4				2			2		
1.5.5			1				1		8
Total Q 1	22	21	3	4	5	0	12	33	50

SECTION B	Cognitive Levels				Content				
Question 2	A	B	C	D					
	Basic knowledge	Comprehension	Application	Analysis, Synthesis & Evaluation	DNA: Code of Life	Meiosis	Genetics and Inheritance	Evolution	Total Question 2 (40)
2.1.1	1							1	
2.1.2			5					5	
2.1.3(a)			7					7	
2.1.3(b)				2				2	15
2.2.1	1						1		
2.2.2			3				3		
2.2.3			2		2				
2.2.4			2		2				
2.2.5		6					6		
2.2.6		3					3		17
2.3.1	2						2		
2.3.2				4			4		
2.3.3				2			2		8
Total Q 2	4	9	19	8	4	0	21	15	40
Question 3	**A**	**B**	**C**	**D**	**Content**				
	Basic knowledge	**Comprehension**	**Application**	**Analysis, Synthesis & Evaluation**	**DNA: Code of Life**	**Meiosis**	**Genetics and Inheritance**	**Evolution**	**Total Question 3 (40)**
3.1.1				4				4	
3.1.2	7							7	
3.1.3				3				3	14
3.2.1	1					1			
3.2.2		2				2			
3.2.3		1				1			
3.2.4	5					5			
3.2.5	5					5			14
3.3	8				8				8
3.4	4							4	4
Total Q 3	**30**	**3**	**0**	**7**	**8**	**14**	**0**	**18**	**40**

SECTION C	Cognitive Levels								
Question 4	A	B	C	D	Content				
	Basic knowledge	Comprehension	Application	Analysis, Synthesis & Evaluation	DNA: Code of Life	Meiosis	Genetics and Inheritance	Evolution	Total Question 4 (20)
Total Q 4	4	5	8	3	7	0	13	0	20
Quest 1	22	21	3	4	7	0	12	31	50
Quest 2	4	9	19	8	4	0	21	15	40
Quest 3	30	3	0	7	8	14	0	18	40
Quest 4	4	5	8	3	7	0	13	0	20
Total	60	38	30	22	24	14	46	66	150
Norm mark	60	38	30	22	27	12	45	66	150