NATIONAL
SENIOR CERTIFICATE

GRADE 12

MARKS: 150

This memorandum consists of 11 pages.

PRINCIPLES RELATED TO MARKING LIFE SCIENCES 2012

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 and 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-recognised abbreviations**
   Accept if first defined in answer. If not defined, do not credit the unrecognized 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.

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 given in terminology**
    Accept provided it was accepted at the National memo discussion meeting.

14. **If only letter is asked for and only name is given (and vice versa)**
No 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. 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 External moderators where necessary)

20. Only memoranda bearing the signatures of the national Internal Moderator and the UMALUSI moderators and distributed by the National Department of Education via the Provinces must be used during training and during the marking period.

SECTION A

QUESTION 1

1.1 1.1.1 B✓✓
     1.1.2 C✓✓
     1.1.3 C✓✓
     1.1.4 A✓✓
     1.1.5 B✓✓
     1.1.6 A✓✓
     1.1.7 B✓✓
     1.1.8 D✓✓
     1.1.9 C✓✓
     1.1.10 B✓✓ (10 x 2) **(20)**

1.2 1.2.1 Recessive✓
     1.2.2 Autosomes✓
     1.2.3 Cloning✓
     1.2.4 Polyploidy✓
     1.2.5 Genetic engineering✓/Genetic modification/Biotechnology
     1.2.6 Independent ✓variable
     1.2.7 Genome✓
     1.2.8 Locus ✓
     1.2.9 Extinction✓ **(9)**

1.3 1.3.1 B only✓✓
     1.3.2 B only✓✓
     1.3.3 A only✓✓
     1.3.4 None✓✓
     1.3.5 Both A and B✓✓
     1.3.6 A only✓✓ (6 x 2) **(12)**

1.4 1.4.1 A✓ (1)

     1.4.2 Opposable thumbs✓with power and precision grip
            Bare fingertips✓with nails
            Long arms✓
            Freely rotating arms✓
            Eyes in front✓
            Stereoscopic vision ✓
            Eyes with cones✓
            Large brain size compared to body mass✓
            Two mammary glands✓
            Sexual dimorphism✓
            Olfactory brain centre reduced✓

            (Mark first THREE only) Any 3 (3)

1.4.3   Humans✓   (1)

1.4.4   Shift in the position of foramen magnum✓ to a forward position
         Gently curved jaws✓
         Flat face✓
         Well developed chin✓
         Not prognathus✓
         Forehead less sloping✓
         No pronounced brow ridges✓
         Smaller canines✓/
         Spaces between teeth bigger✓
         Larger brain size✓

         (Mark first TWO only)   Any 2   (2)

1.4.5   Rhesus monkey✓
         Gibbon✓   (2)
                                                                            (9)

                                              TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1   2.1.1   A – chromatid✓/chromosome
                 B – Spindle✓ fibre   (2)

        2.1.2   Diagram 3, Diagram 2, Diagram 1✓✓ (in correct sequence)   (2)

        2.1.3   Crossing over✓ in diagram 3
                 Chromosomes moving to poles✓ in diagram 1
                 Bivalents (homologous pair of chromosomes) lie in the equator✓ in
                 diagram 2
                 (Mark first TWO only)   Any 2   (2)
                                                                    (6)

2.2   2.2.1   Normal male karyotype has an X and Y chromosome ✓ at 23
                 Klinefelter syndrome karyotype has an extra X chromosome ✓/
                 3 chromosomes at number 23/two X and one Y chromosomes   (2)

        2.2.2   During meiosis 1 ✓ the homologous chromosome pair 23✓ of the
                 female ✓parent does not separate✓/there is non-disjunction
                                   OR
                 During meiosis 2 ✓ the chromosome 23✓ of the female ✓parent
                 does not separate✓/non-disjunction of chromosome and both
                 chromatids move to same pole

                 an ovum with 2 X chromosomes✓ is produced
                 during fertilization✓ this ovum fused with a sperm cell with a Y
                 chromosome✓ to form the zygote with XXY ✓/47 chromosomes
                                                        Any 6   (6)
                                                            (8)

2.3

	Father	Mother
P$_1$/parent phenotype	No white forelock x	White forelock ✓
genotype	hh x	Hh ✓

Meiosis

G/gametes   h, h x H,   h✓

Gametes	H	h
h	Hh	hh
h	Hh	hh

1 mark for correct gametes
1 mark for correct genotypes

Fertilisation   **OR**

F$_1$ genotype   Hh , hh , Hh , hh ✓
Phenotype   2 x without 'white forelock' & 2 x with 'white forelock' ✓

Parents and offspring✓/P$_1$ and F$_1$
Meiosis and fertilisation✓   **Max**   **(6)**

2.4	2.4.1	Co-dominance✓	(1)

2.4.2   Both alleles✓ expressed themselves equally✓ in the phenotype✓ of the offspring   (3)

2.4.3   (a) RR✓✓
           (b) RW ✓✓
           (c) WW✓✓   (3 x 2)   (6)
                                                                          (10)
                                                                                                  [30]

QUESTION 3

3.1   3.1.1   To identify specific defective genes✓/to find out if they are possible carriers   (1)

3.1.2
- To be given advice on the risk of transferring the defective gene✓/ to find the probability of passing on the defective gene to offspring
- To be able to make decisions on whether they want to have children✓
- To be given explanation of the results of DNA✓
- To be given explanation of procedure to be involved in DNA testing✓   (3)

(Mark first THREE only)   Any 3 **(4)**

3.2   Identify criminals✓/biological evidence
Identify deceased bodies✓
Identify relatives✓/ missing person/paternity
(Mark first TWO only)   Any 2 **(2)**

3.3

Australopithecus sediba	*Homo sapiens*
Smaller skeleton size✓	Increased skeleton size✓
Smaller cranium size✓	Much larger cranium✓
Less developed chin✓	More developed chin✓

                                      3 x 2 + 1 table   **(7)**

3.4   3.4.1   They can interbreed✓ and produce fertile offspring✓/puppies which can interbreed   (2)

3.4.2
- there is variation in the wolves in terms of aggressive behaviour✓/ feeding habits
- a population of less aggressive/more tame wolves✓ became scavengers✓ around human settlements and were separated✓ from the original wild population
- each group occupying a niche undergoes natural selection✓
- as a result of varying environmental conditions✓

- and develops differently✓
- genotypically✓ and phenotypically✓
- gene flow✓/reproduction between the different populations does
  not occur
- The differences that develop between the different populations
  prevent them from inter-breeding✓even if they were to mix
- such that one or both groups become a new species✓

Max 6   (6)

3.4.3   Humans✓ chose the dogs that had the best/desired characteristics✓and interbred✓ them
Over many generations✓ of careful selection a desired breed of dog was achieved   Any 2   (2)

(10)

3.5   3.5.1   Accepted✓/not rejected   (1)

3.5.2   The bacteria✓/single-cell organisms appear in the oldest rock layers✓/strata/multi-celled✓/complex organisms appear later in Palaeozoic era✓/older era✓ is equivalent to older rock strata✓

Any 2   (2)

3.5.3   It would indicate that complex organism did not evolve from simple organisms✓ therefore the theory will be rejected✓

OR

It would mean that first protists and dinosaurs co-existed✓ therefore dinosaurs did not evolve from protists✓   (2)

3.5.4   Invertebrates have soft bodies✓ which decay easily✓/ do not fossilise

OR

Some invertebrates may have had an exoskeleton✓ which decays easily✓/ does not fossilise
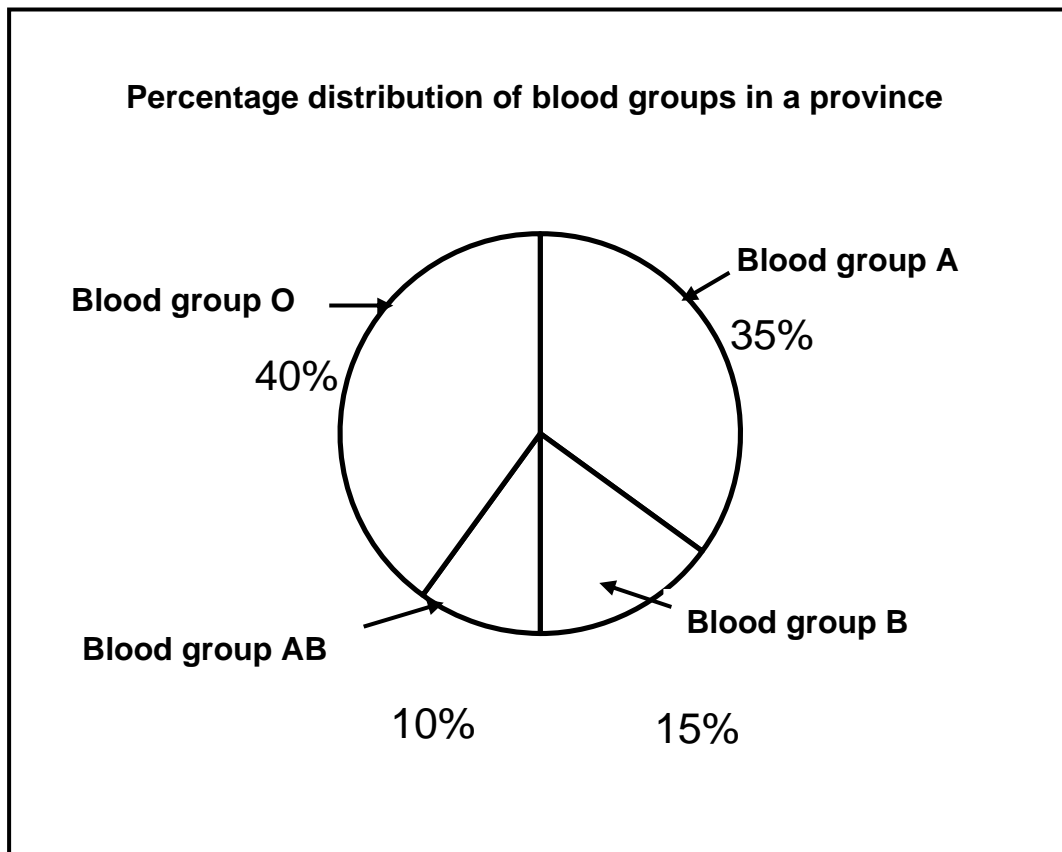
OR

Earlier fossils of invertebrates✓ might not yet have been discovered✓   (2)

(7)
[30]

TOTAL SECTION B: 60

SECTION C

QUESTION 4

4.1　　4.1.1　　One✓　　　　　　　　　　　　　　　　　　　　　　　　　(1)

　　　　4.1.2　　Blood groups are controlled by three alleles✓/ I^A , I^B , I which when
　　　　　　　　in combination provide four phenotypes✓/A, AB, B, O.　　　(2)

　　　　4.1.3

Percentage distribution of blood groups in a province

Blood group O — 40%
Blood group A 35%
Blood group AB 10%
Blood group B 15%

Blood group A:　　$\dfrac{35}{100}$ x $\dfrac{360}{1}$
　　　　　　　　　= 126°

Blood group B:　　$\dfrac{15}{100}$ x $\dfrac{360}{1}$
　　　　　　　　　= 54°

Blood group AB:　　$\dfrac{10}{100}$ x $\dfrac{360}{1}$
　　　　　　　　　= 36°

Blood group O:　　$\dfrac{40}{100}$ x $\dfrac{360}{1}$
　　　　　　　　　= 144°

　　　　　　　　　　　　　　　　　　　　Please turn over

Rubric for the mark allocation of the calculations

Marks	Calculations
1	1–3 correct
2	4 correct

Rubric for the mark allocation of the pie chart

Caption	1
Correct proportion of slices	1: 1–2 correct 2: 3–4 correct
Label / key for each slice	1: 1 correct label 2: 2 correct label 3: 3–4 correct labels

(8)

NOTE: If the wrong type of illustration is drawn: marks will be lost for drawing the slices in correct proportions

(11)

4.2   4.2.1   The average height ✓of the plants decreases✓ as the altitude✓ increases✓

OR

The average height ✓of the plants increases ✓as the altitude✓ decreases✓   Max 3   (3)

4.2.2   All seeds from different altitudes were planted under the same environmental conditions✓
Same number of seeds for each level was used✓
(Mark first TWO only)   (2)

4.2.3   - There is variation in the height of this plant population✓/ some plants are tall and some are short
- More short plants survived✓ at high altitude to reproduce the next generation
- Because the short plants are not easily broken by wind at high altitude✓/ harsh environmental conditions at high altitude
- Tall plants did not survive the strong winds/environmental conditions at high altitude✓/ Fewer tall plants survived✓ at high altitude   Max 4   (4)

(9)

Please turn over

4.3　　**Possible answer**
　　　GENE MUTATIONS
　- Errors✓/mistakes/changes may occur during transcription✓/ DNA replication
　- **Point mutations**: replacing/substituting one base of a codon with another✓
　- Small change that may possibly result in one amino acid ✓changing in a
　　protein
　- **Frame-shift mutations**: addition/deletion of one or more bases of a codon✓
　- Resulting in changing the order/sequence of all the bases of the codons ✓
　- Resulting in forming a different protein✓ with different functions✓
　- Lead to different phenotypes✓

Max　　(6)

MEIOSIS

Crossing–over✓
- Homologous chromosomes✓/bivalents pair up
- Each chromosome has 2 chromatids✓
- Non-sister chromatids overlap/cross over✓
- Points at which crossing-over takes place are referred to as chiasmata✓
- Genetic material is exchanged✓ between non-sister chromatids✓
- After the process of crossing-over chromosomes have alleles from its
　homologous partner ✓
-This means that each gamete formed will have a mix of alleles from both
　parents✓
- Brings about variation in the gametes ✓formed and also the offspring

Max　　(7)

Random arrangement of chromosomes ✓at the equator
- Each pair of homologous chromosomes ✓may line up either way up on the
　equator of the spindle ✓
- Independently of what the other pairs are doing✓
-This means that gametes will have differing number/mix of both
　parental chromosomes ✓　　　　　　　　　　　　　　　　**Max　　(4)**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(17)

ASSESSING THE PRESENTATION OF THE ESSAY

Marks	Descriptions
3	Well structured – demonstrates insight and understanding of question
2	Minor gaps in the logic and flow of the answer
1	Attempted but with significant gaps in the logic and flow of the answer
0	Not attempted/nothing written other than question number

Synthesis　(3)
　　　　　　　(20)

TOTAL SECTION C:　**40**
GRAND TOTAL:　**150**