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Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

SEPTEMBER 2012

**LIFE SCIENCES P1
MEMORANDUM**

MARKS: 150

This memorandum consists of 9 pages.

SECTION A

QUESTION 1

- 1.1 1.1.1 A ✓✓ (2)
 1.1.2 B ✓✓ (2)
 1.1.3 B ✓✓ (2)
 1.1.4 A ✓✓ (2)
 1.1.5 B ✓✓ (2)
 1.1.6 B ✓✓ (2)
 1.1.7 D ✓✓ (2)
 1.1.8 C ✓✓ (2)
 1.1.9 C ✓✓ (2)
- 1.2 1.2.1 Speciation ✓ (1)
 1.2.2 Allopatric/Geographical ✓ speciation (1)
 1.2.3 *Sapiens* ✓ / *Homo sapiens* (1)
 1.2.4 Prognathic/Prognathous ✓ (1)
 1.2.5 Lucy (*Australopithecus afarensis*) ✓ (1)
 1.2.6 Hominids ✓ (1)
- 1.3 1.3.1 A (A only) ✓✓ (2)
 1.3.2 None ✓✓ (2)
 1.3.3 B (B only) ✓✓ (2)
 1.3.4 A (A only) ✓✓ (2)
 1.3.5 Both (A and B) ✓✓ (2)
 1.3.6 A only ✓✓ (2)
 1.3.7 B only ✓✓ (2)
 1.3.8 None ✓✓ (2)
- 1.4 1.4.1 Sympatric speciation ✓ (1)
 1.4.2 Sympatric speciation is brought about by a radical change in the genome ✓ of a small group ✓ of individuals in the original population while sharing the same habitat. ✓ **OR**
 In Lake Malawi, the existence of various layers of ecological niche, with unique food sources, at different depths ✓ led the fishes to adapt and modify their structures ✓ to suit the collection of preferred food items. Over millions of years, each school of fishes evolved as separate species. ✓ **OR**
 Furthermore, intensity of sun light penetration ✓ at various depths also caused different colouration and visibility ✓. The fishes with similar light sensitivity started forming their own schools and at specific niches at various depths of the lake. ✓ (3)
 1.4.3 Reproductive isolation mechanism ✓ (1)
 1.4.4
 - Habitat isolation ✓ Living in different niches in the same area
 - Temporal isolation ✓ Breeding at different times of the year
 - Behavioural isolation ✓ Species specific courtship behaviour
 - Mechanical isolation ✓ Adaptation to different pollinators
 - Hybrid isolation ✓ Infertile off-spring
 (5)

TOTAL SECTION A: 50

SECTION B**QUESTION 2**

- 2.1 2.1.1 *Eupodophis desouensi* ✓ (1)
- 2.1.2 95 million years ✓ (1)
- 2.1.3 Radiometric dating ✓/absolute dating ✓ (1)
- 2.1.4 Cretaceous period ✓ (1)
- 2.1.5 A small hind leg (vestigial organ) was found attached to its pelvis ✓ (1)
- 2.1.6 Ultra-sharp 3-D x-ray imaging ✓ (1)
- 2.1.7
- According to Lamarck, if an organ was disused, it became smaller and smaller until it totally disappeared ✓
 - The legs of the snake disappeared because it did not use them in its gliding movement ✓
 - Its body became thin and long to allow it to crawl through narrow spaces ✓
 - Therefore, the legs disappeared completely due to consistent disuse ✓ (any 3) (3)
- 2.1.8 Lamarck's theory was rejected by many scientists because:
- There is no evidence to suggest that acquired characteristics (changes brought about by adaptation to the environment) are inherited from parent to offspring. ✓
 - Organisms do not control the direction or nature of their own transformation by themselves. The transformation of individuals takes place randomly in response to the environment ✓
 - Population as a whole undergoes change but according to Lamarck, only those individuals with the new acquired features are able to change in a population. The rest of the original population remains unchanged ✓ (3)
- 2.2 2.2.1 There will be a steady increase in the use of genetically modified crops. ✓ (1)
- 2.2.2
- Resistance to drought ✓
 - Resistance to insects ✓
 - Resistance to herbicides ✓
 - High yield ✓ (4)
- 2.2.3 Maize, ✓ Soya beans ✓ and cotton. ✓ (3)

- 2.2.4 South Africa does not have a high annual yearly rainfall✓ and also do not have many rivers from which irrigation can be done. ✓ (2)
- 2.2.5
- Are costly to produce as they involve modern biotechnology which requires highly skilled people, sophisticated and expensive equipment. ✓
 - Crops may include pesticide resistant gene that may unintentionally harm the wild life ✓
 - Reduce genetic diversity ✓
 - Can easily be destroyed by new disease. ✓
 - Can interbreed with wild plants and spread to future generations in uncontrollable way and have the potential of becoming a super weed. ✓
 - May cause allergic reactions in humans. ✓
 - Religious objections. (Scientists playing GOD and tamper with God's creations) ✓ (any 4) (4)
- 2.2.6
- Increased shelf life ✓
 - Increased size ✓
 - Increased nutritional value ✓
 - Increased resistance to high temperature ✓
 - Attractive appearance ✓ e.g. colour.
 - Increased resistance to insect attack. ✓
 - Delayed ripening. ✓ (any 3) (3)
- 2.2.7
- Right to information✓ regarding the type of food.
 - Right to select food items according ones preference. ✓ (Right of choice) (any 1) (1)
- [30]

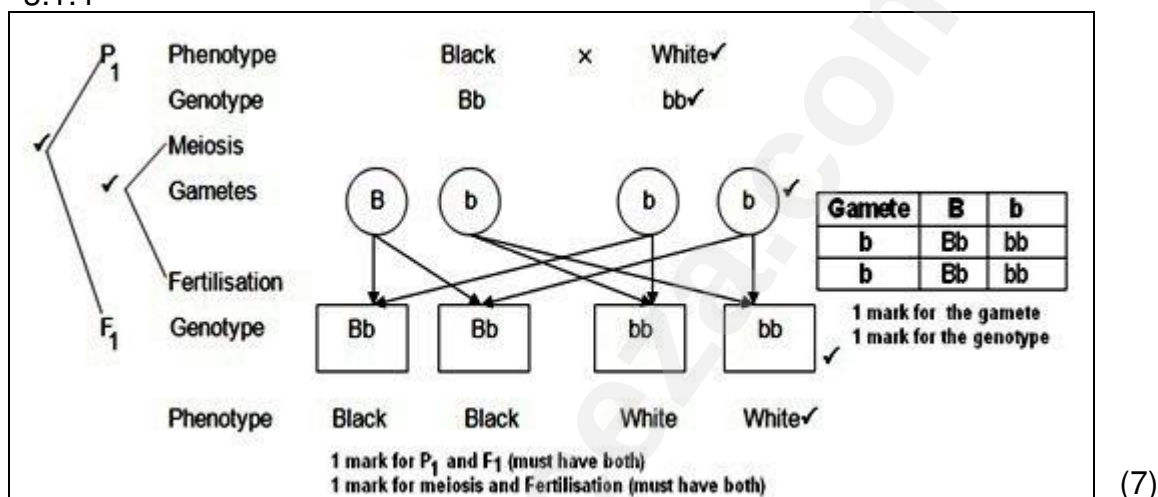
QUESTION 3

3.1 3.1.1 Male parent **Bb** ✓
 Female parent **Bb** ✓ (2)

3.1.2 $\frac{1}{4} \times 100 = 25\%$ ✓ (2)

3.1.3 3:1 ✓ (1)

3.1.4



3.2 3.2.1 Recombinant DNA technology/Genetic engineering ✓ (1)

3.2.2 A – Plasmid ✓ (1)

3.2.3 B – Restriction enzymes ✓
 C – Ligase enzymes ✓ (2)

3.2.4 Mitosis ✓ (1)

3.2.5

- The product is produced rapidly ✓ in large quantities ✓
- Is relatively inexpensive ✓
- Has few side effects ✓ and is considered as a natural product ✓
- No religious resistance ✓ (any 2) (2)

3.2.6 Yeast cells ✓ (1)

3.2.7

- Are readily available ✓
- More cost effective than *E. coli* ✓
- Reproduce rapidly ✓ (any 1) (1)

- 3.3 3.3.1 The bivalents/homologous pairs of chromosomes arrange themselves on the equatorial plane✓ in such a way that the centromeres of the homologous partners become attached to the same spindle fibre/centromeres of chromosomes are at equal distances from the equator ✓ (any 1) (1)
- 3.3.2 Crossing over✓ (1)
- 3.3.3 Homologous chromosome pairs did not separate and move to the opposite poles, instead, all the homologous chromosome pairs move to one pole ✓ (1)
- 3.3.4 Chromosomal non-disjunction ✓ (1)
- 3.3.5 Triploid ✓ (1)
- 3.3.6 Polyploidy ✓ (Triploidy) (1)
- 3.3.7 The phenomenon mentioned above leads to the production of:
- Larger flowers ✓
 - Larger fruits ✓
 - Larger storage organs ✓ (any 2) (2)
- 3.3.8 Leads to instant speciation✓ (1)
- [30]**

TOTAL SECTION B: 60

SECTION C

QUESTION 4

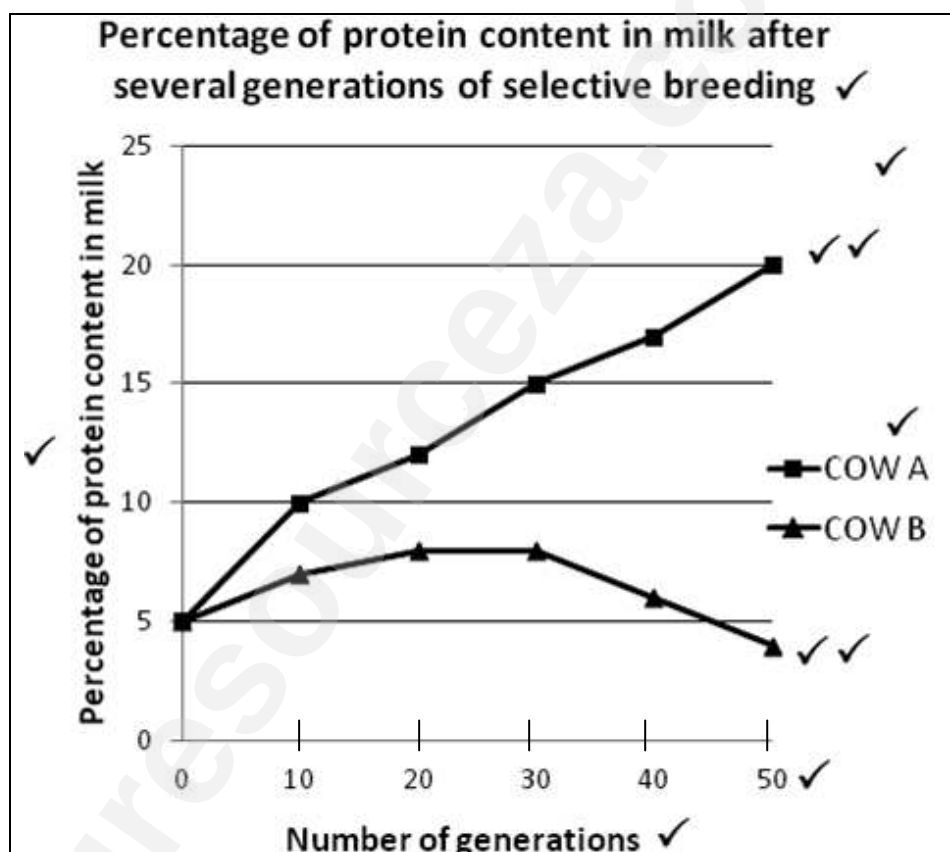
4.1 4.1.1 Consistent selective breeding of cows will increase the protein content ✓ of milk over many generations of breeding ✓ **OR**

Consistent selective breeding of cows will decrease the protein content ✓ of milk over many generations of breeding ✓ **OR**

The protein content ✓ in the milk of cows will increase over many generations of selective breeding. ✓

(2)

4.1.2



Rubric for the mark allocation of the graph

Correct type of graph	1
Caption for graph	1
Correct label for X-axis	1
Correct scale for X-axis	1
Correct label for Y-axis	1
Graphs labelled/key provided for 2 graphs	1
Drawing of graphs	2 – 6 points plotted and joined correctly in a graph 4 – all 12 points plotted and joined in both graphs

(10)

- 4.1.3 $17\% - 10\% = 7\%$ ✓ (1)
- 4.1.4 $17\% - 6\% = 11\%$ ✓ (1)
- 4.1.5 The selective breeding has improved the protein content of the milk.✓ (1)
- 4.1.6 Cloning a cow with an advantageous characteristic ✓ (1)

- 4.2
- There are variants in any populations. ✓ The bacterial population also displayed variants within its population.
 - When an antibiotic treatment is administered to treat a bacterial infection, most of the bacteria (non-resistant) are eliminated✓
 - But some variant forms of bacteria (resistant forms) within the same population have an advantageous gene which is insensitive to the antibiotics✓ (able to withstand the effect of antibiotics)
 - Those variant forms of bacteria with an advantageous gene against the antibiotics (drug resistant type) succeeded other forms of bacteria through natural selection✓ and those that survived begin to breed (multiply in numbers) successfully✓
 - They transfer their stronger genes to the next generation✓ and a new population of drug resistant bacteria emerges ✓ (any 4) (4)

4.3 Faulty DNA replication

- Sometimes, mistakes do happen during DNA replication and it leads to changes in the natural sequence of nucleotides in the DNA strand. **This sudden change✓ in the genetic information** is known as **mutation**.✓
- A **single nucleotide** base change in the DNA is known as a **point mutation**. ✓ A point mutation may consist of the loss of a nucleotide (deletion)✓, the insertion ✓ or the substitution of one nucleotide for another.✓
- An altered single nucleotide may cause changes in the amino acid sequence,✓ as well as the structure✓ and function of the protein product✓ (Point mutation only affects a single amino acid in a protein chain)
- A **frameshift mutation** is a type of gene mutation where the addition or deletion of (a number of) nucleotide(s) causes a shift in the reading frame of the codons in the mRNA.✓ This, may eventually lead to the alteration in the amino acid sequence at protein translation.✓
- Frameshift mutations arise when the normal sequence of codons is disrupted by the insertion or deletion of one or more nucleotides, provided that the number of nucleotides added or removed is not a multiple of three.✓ Frameshift mutation affects every single codon after the shift occurs. This can result in the incorporation of many incorrect amino acids into the protein.✓
- Altered DNA structure thus produces m-RNA with a wrong code during transcription process. ✓

- This in turn, results in the use of wrong t-RNA to pick-up wrong amino acid.✓
- The wrong type and sequence of amino acids lead to the formation of wrong proteins. ✓

The wrong protein production causes the production of wrong enzymes✓ and disrupts the essential metabolic processes✓ leading to various genetic disorders such as haemophilia, ✓ Albinism,✓ sickle-cell anaemia✓ etc.

(max:11) (11)

Genetic disorders

- Sickle cell anaemia is a blood disorder in which the red blood cells lose their round shape and collapse into sickle shape.✓ This disorder is caused by point mutation that results in an amino acid change from normal adult haemoglobin (haemoglobin A) to abnormal sickle-shaped haemoglobin (haemoglobin S).✓
- Albinism is a genetic disorder characterised by the lack of melanin.✓ The mutation results in the early termination of production of an enzyme tyrosinase necessary for the synthesis of an amino acid known as tyrosine from where melanin is formed.✓
- Haemophilia is a genetic disorder characterised by frequent, excessive bleeding as blood clots very slowly.✓ This is caused by a mutation that leads to a failure in producing a protein which acts as a clotting factor that works with platelets to stop bleeding at the site of an injury.✓

(6)
(17)

Synthesis

NO marks will be awarded for presentation if the essay is written in a point form.

ASSESSING THE PRESENTATION OF THE ESSAY

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

(3)

TOTAL SECTION C: 40

GRAND TOTAL: 150