NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2015

LIFE SCIENCES: PAPER I

MARKING GUIDELINES

Time: 3 hours 200 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

QUESTION 1

COLUMN A		COLUMN B	
[C]	Organisms that share a gene pool.	A	Ecological succession
[K]	A limiting factor on population growth that has nothing to do with the size of the population.	B	Climax community
[L]	Community of organisms that first inhabit a new area.	C	Species
[I]	Kudu bulls fighting over a female for mating.	D	Natality
[J]	A method of estimating a fish population in which tags are used to identify sampled fish.	E	Ecosystem
[A]	The process by which the composition of a biological community changes over time.	F	Interspecific competition
[H]	This factor slows down an increase in population size.	G	Quadrat
[D]	Population parameter that increases population size.	H	Environmental resistance
[E]	All living and non-living factors interacting with each other in a particular environment.	I	Intraspecific competition
[B]	Final stage of ecological succession.	J	Mark-recapture
		K	Density-independent factor
		L	Pioneers

(10)

1.2

1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6	1.2.7
A (1)	D (1)	C (1)	C (1)	B (2)	A (2)	B (2)

(10)

1.3

COLUMN I	COLUMN II	ANSWER
Guanine	1. a sugar molecule 2. a phosphate molecule	**D**
Hydrogen bonds	1. links Thymine to Adenine 2. links deoxyribose sugar to phosphate	**A**
Centromere	1. point at which two homologous chromosomes are joined 2. point at which two identical chromatids are joined	**B**
James Watson	1. contributed to the discovery of the structure of DNA 2. worked together with Francis Crick	**C**
Mitochondrial DNA	1. inherited through the paternal line 2. inherited through the maternal line	**B**

(5)

1.4

S – A OR S – P – S – P – S – P – S – P – S – P – S – P – S – P – S – P – S – P
P | | | | | | | | |
S – C A C G G U A A G U
P
S – G
P
S – G Labels: Sugar,
P phosphate
S – U N-base (or names)
P nucleotides (**max 3** out of poss 4)
S – A
P
S – A
P
S – G 3 codons chosen (ACG, GUA, AGU) correct (no matter sequence)
P base sequence correct (1 out of sequence) (2 out of sequence 0)
S – U
P Alternating S-P backbone correct
Bases linked to S (8)

1.5 1.5.1 Recessive. Individual 1 and 2 are normal but they have affected daughters (individual 4 + 5) so the mutation must have been carried silently. (3)

1.5.2 Heterozygous (1)

1.5.3 25% (1)

1.6 1.6.1 Forest community means there are a number of populations/different species/groups of plants and animals/not just 1 species living together; interacting in one area/same place/not in isolation. (2)

1.6.2 $\text{Pop} = \frac{\text{Average number per quadrat} \times \text{size of area}}{\text{Size of quadrat}}$

$= \frac{\frac{(4+4+4+2+1+3)}{6} \times 12\ 000\ \text{m}^2}{100\ \text{m}^2}$ OR 3×120

$= 360$ $= 360$ (4)

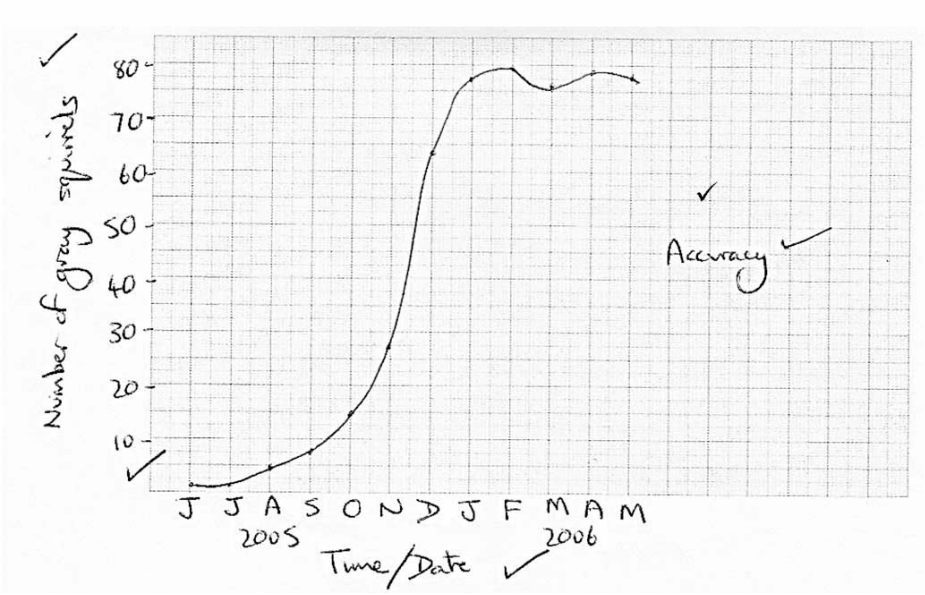
Answer only (no working) max 1

1.6.3 Quadrats must be randomly placed.
Size of whole area must be known.
Size of quadrats must be constant.
Size of quadrat must be known.
Accurate counts within quadrat must be done.
Sufficient number of quadrats must be counted.
Method should be repeated and averaged for more reliable results.
(Any 3 points) (3)

1.6.4 Niche partitioning/resource partitioning. Different plant species grow to different heights/strata in response to different light requirements and so they are able to live together. (3)

1.6.5 Secondary succession (2)

1.6.6 (a) Heading: Graph showing population size/number of Grey Squirrels over time.



(7)

(b) Establishing nests/finding mates/adjusting to new area. (2)

(c) Abundant resources/well below carrying capacity so no environmental resistance resisting growth. (3)

(d) The maximum number of individual of a population that the environment can sustain. (2)

(e) 75 – 80 (1)

1.7

		Statement	A, B or C
1.7	1.7.1	There are 1 215 rhino left in South Africa.	C
	1.7.2	The number of poached rhino has shown a sharp upward trend in the past five years.	A
	1.7.3	After 2016 we should see living rhino numbers levelling off.	B
	1.7.4	Rhino poaching is a crime punishable by law.	C
	1.7.5	From 2012 – 2013, the number of rhinos poached increased by 336.	A

(5)

1.7.6 Any two reasonable suggestions:
Education/Stronger sentences for poachers/Dehorning/Dye in horns/Toxin in horns/DNA profile rhinos/More armed guards/Protected areas, etc. (2)

1.8 1.8.1 C – D – B –A (1 wrong – ; 2 or more wrong – 0) (2)

1.8.2 (a) Crossing over (1)

(b) Causes shuffling of genes, which leads to variety in gametes, which causes increased genetic variation in population. (3)

[80]

QUESTION 2

2.1 2.1.1 Large number of animals in hunt allows them to take down prey larger than themselves.
Pack can develop strategies for the hunt involving spreading out over large area to trap prey.
Pack can attack animal from all sides, which confuses prey ensuring successful kill.
Single breeding pair ensures that most of pack is in peak physical condition for hunting.
Nursemaids left to look after pups ensures that hunting pack is focused on hunt and not on protecting young.
Individuals take turns in leading the chase ensuring that the whole pack does not tire. Communication within pack leads to the ability to hunt as a collective force. (Any 3) (3)

2.1.2 The herd keeps the young in the centre to protect them
The herd has many eyes and ears to detect danger of predators
The sheer size of the herd will intimidate predators
When the herd moves, all the individual movements cause a confusing mass, which does not allow predator to focus. (Any 1 × 2) (2)

2.1.3 B – African Wild Dog
Number of predators always lower than prey.
Predator graph lags behind prey graph. (3)

2.2 Death + Emigration (2)

2.3 2.3.1 Wanted to increase population/war had reduced their population. (2)

2.3.2 Smaller economically active sector of population/workforce to support rest/ young and aged, so current pop will have to prepare for this in terms of infrastructure; OR less females so not enough partners for men leads to changing culture, overflowing orphanages. (max 2 for each point) (4)

2.3.3 Incentive scheme rather than punishment.
Education campaign re family planning. (2)

2.3.4 C Reduced birth rate due to contraception. Pyramid narrows at bottom. (3)

2.4 Variation in bacterial pop → antibiotics incorrectly administered → more resistant bacteria survive while less resistant die → more resistant reproduce → entire population of resistant bacteria/increase in resistant bacterial population (**good logical flow diagram** – not cycle) (4 + 1 = 5)

2.5 2.5.1 Resistance of bacteria to penicillin/number/amount/proportion of bacteria killed/size of clear zone. (Answer must refer to death or survival of bacteria.) (1)

2.5.2 Type of bacteria (1)

2.5.3 Quantity/conc. of bacteria; size of well; quantity/quality of penicillin; size of Petri dish; temp at which Petri dishes were kept; type/brand of nutrient agar; amount of nutrient agar. (Any 3) (3)

2.5.4 Bacteria (A/B/C/D/E) has the greatest resistance to penicillin (statement)./ Antibiotic resistance varies between different bacteria./All bacteria are equally resistant to penicillin. (3)

2.5.5 C. Because there was no clear zone around it meaning that no bacteria were killed by the antibiotic. (3)

2.5.6 (a) To ensure that the penicillin was causing the death of bacteria and not another factor.
For comparison (2)

(b) Penicillin (1)
[40]

QUESTION 3

3.1 3.1.1 Divergent. They developed from a common structure found in ancestral species, but have become modified to suit their particular environmental needs. (modification with descent). (3)

3.1.2 In the ancestral species there was variation in leaf size. Those that had small leaves had an advantage when climate became hotter and dryer, because they did not lose as much water through transpiration. Those individuals would have survived (survival of the fittest/natural selection) and thus passed on their genes for small leaves to the next generation. The plants with larger leaves lost too much water and died. They did not survive to pass on their genes to next generation. Over time the proportion of small-leafed plants increased, which led to the formation of the cactus species. (7)

3.2 3.2.1 Light brown coloured because their colour prevented predation so they lived longer/produced more pups/offspring. (3)

3.2.2 White (1)

3.2.3 Predation the ones that were camouflaged had better survival rates than those that stood out. (2)

3.3 3.3.1 Foot E (1)

3.3.2 Position of big toe at top – to balance/propel forward.
Length/size of toes small – to balance/propel forward.
Heel region large for upright posture to balance.
Wide foot to distribute weight in upright position.
Toes in line for standing and walking. (2 × 2 = 4)

3.3.3

Freed up arms to carry young	– protection of young
Freed up arms to carry food	– young/old/sick were better cared for/fed
Freed up arms for toolmaking	– better able to capture prey
Freed up arms to control fire	– able to cook better for better nutrition
Could start fires/control fire	– development of culture as groups sat around fire
	– Caused development of language (3 × 2 = 6)

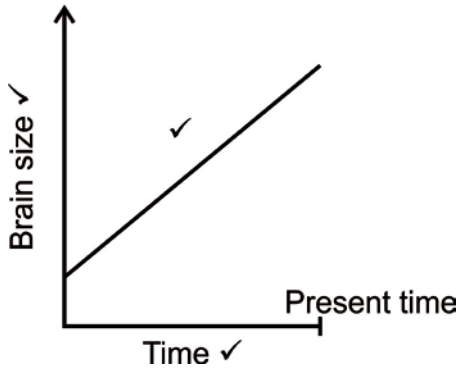
3.3.4 Cranial capacity larger in E.
Ridges for muscle attachment (sagittal crest and eyebrow ridges) only evident in A.
Snout projecting forward in A compared with flatter face in E.
Larger jaws in A.
Larger, sharper teeth in A.
More regular dentition in E.
Position of foramen magnum towards the middle of the skull.
Or any reasonable answer (2)

3.4 3.4.1 250 – 500 cm^3 (2)

3.4.2 ± 1.2 million years old. Brain size 1 100 – 1 200 cm^3 (2)

3.4.3 400 000 – 500 000 years ago (in that range) (1)

3.4.4



(3)

3.5 3.5.1 Larger cranium cavity/flatter face/eyes facing forward (1)

3.5.2 Mark according to feature listed:
- Larger cranium indicates increased brain size which would give them higher cognitive function/the ability to think better and thus design tools/ better communication/better hunting methods, etc.
- Flatter face/eyes facing forward meant better binocular vision – better hunting/perception of danger (2)

[40]

QUESTION 4

4.1 4.1.1 A DNA test is a medical procedure done to analyse genetic information/ chromosome analysis. (Definition 1 mark)
DNA sample amplified using PCR.
A DNA sample is subjected to gel electrophoresis (or a description of process).
It separates into different bandwidths according to mass.
This gives a picture known as a DNA profile/fingerprint.
(Explanation max 2 marks or any other reasonable explanation) (3)

4.1.2 FOR: It was not their fault – their baby belongs to them so should be returned to them. Or anything suitable.
AGAINST: Already bonded with other baby/too traumatic to separate/or anything suitable. (4)

4.1.3 Child 1 is the biological child as their DNA bands match one of the parents' bands (or Child 2 is not as their DNA bands do not match either of parents' bands. (2)

4.1.4 Identifying dead bodies/linking criminals to crime/identifying source of poached plants and animals or anything suitable (not paternity). (2)

4.2 4.2.1 X-chromosome (1)

4.2.2 Mainly males get the disease as in females, if they have a mutated gene, they may have a healthy gene to mask the recessive mutated gene.
It is a rare disorder – if it was a dominant mutation, it would be more prevalent. (4)

4.2.3 Colour blindness – inability to distinguish between colours.
OR Haemophilia – inability to clot blood (or any example) (2)

4.2.4 (a) P_1 genotypes: X^nY x X^N X^N (Wrong if not expressed as X-linked)

	X^n	Y	
X^N	X^N X^n	X^NY	
X^N	X^N X^n	X^NY	

F_1 genotype: 1 X^N X^n: X^NY
F_1 phenotype: 1 carrier (normal): 1 normal male (can say all normal) (7)

(b) Yes: Not fair to bring sick child into world/child will suffer.
Very expensive to raise a sick child or any reasonable answer
No: Can live to adulthood.
Moral or ethical or religious issue with abortion or any reasonable answer. (2)

4.3 4.3.1 Fruit/crop will be very large in future because the seeds from largest fruit have the best genes for fruit production. (2)

4.3.2 (a) Identical to parent plant. (2)

(b) Advantage: All genetically strong so will always have good fruit.
Disadvantage: All the marula trees **are identical** so if there is an environmental stress, there will be no variety to allow some to survive. Whole pop will be wiped out. (2)

(c) No. Because the genes have not been manipulated/modified. (2)

4.4 4.4.1 Easier to get cells same nucleus in each and that's all we want.
Costly – Pancreas cells are hard to access/needs an operation to get pancreatic cells./Pancreas cells are defective because diabetic. (2)

4.4.2 Won't reject them – recognise as own. (1)

4.4.3 Diabetic patient produces insulin and generates continual replacement cells with the ability to produce insulin. (2)
[40]

Total: 200 marks