NATIONAL SENIOR CERTIFICATE EXAMINATION
SUPPLEMENTARY EXAMINATION MARCH 2016

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

1.1

	COLUMN A		COLUMN B
[L]	Organisms that share a gene pool.	A	Charles Darwin
[F]	This results from an inability to adapt to environmental change.	B	Micro-evolution
[G]	The transferring of acquired characteristics to the next generation.	C	Artificial selection
[K]	Inability to breed with another species due to differing breeding mechanisms.	D	Inbreeding
[B]	Small changes that occur within a species over time.	E	Neutral mutation
[J]	The wings of birds and insects develop in this way	F	Extinction
[C]	A farmer chooses the seeds from the biggest, strongest tomato plant for his next crop.	G	Lamarck
[E]	A change in DNA structure which has no effect on phenotype.	H	Divergent evolution
[D]	Type of reproductive behaviour displayed by small isolated populations.	I	Variation
[I]	The appearance of many different phenotypes in a population.	J	Convergent evolution
		K	Reproductive isolation
		L	Species

1.2

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

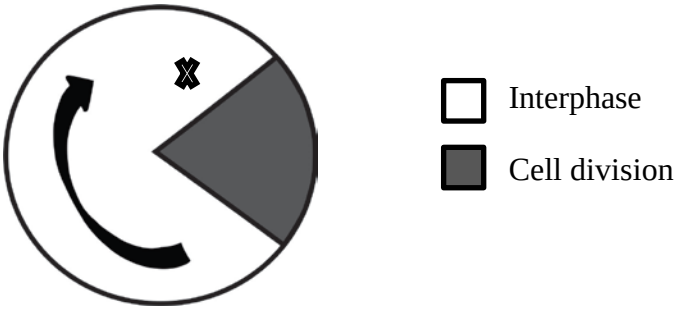
1.3 1.3.1 DNA replication

1.3.2 nucleus/nucleoplasm

1.3.3 B – new
C – original

1.3.4 DNA untwists/uncoils → H-bonds between bases break/strands move apart → complementary bases link onto exposed bases → S-P back-bone joins by condensation/dehydration synthesis → strands separate & recoil.
(+1 flow diagram)

1.3.5



1.3.6 DNA is divided into separate chromosomes which twist up into a helix and wrap around histones/protein molecules or tightly coiled.

1.4 1.4.1 (a) different form of the same gene.

(b) a gene which masks the effect of another/gene whose characteristic is always expressed even in heterozygous form.

(c) a chromosome which is not a gonosome/all chromosomes besides the sex chromosomes.

1.4.2 (a) Prophase II
(b) Prophase I or Metaphase 1
(c) Telophase II

1.4.3 (a) 8
(b) 4
(c) 8

1.4.4 (a) N = normal
n = vestigial

(b)

	n	n
N	Nn	Nn
n	nn	nn

(c) 1 Normal/wild type: 1 vestigial

1.5 1.5.1 (a) GGA
(b) GGA
(c) Leucine

1.5.2 Glutamine – Alanine – Serine
(out of sequence -1)

1.5.3 It would cause a frameshift mutation (or explanation) which would cause different amino acids to be coded for/different protein to be made/might cause the polypeptide build to stop.

1.5.4 No because not a germ-line mutation/not in the gametes/gonads.

1.6 1.6.1 The points at which crossing over occurs during the meiotic process are known as **chiasma/centromeres**.

1.6.2 The number and appearance of all the chromosomes in a particular cell is known as a **genotype/karyotype**.

1.6.3 Cells formed at the end of meiosis will always be **haploid/ diploid**.

1.6.4 Centromeres only ever split during **Anaphase 1/Anaphase II**

1.6.5 Downs Syndrome is an example of a **point/chromosomal** mutation.

1.7 1.7.1 Series of bands that represent sections of DNA of a person. (or similar)

1.7.2 Yes – her bands either match her mother or his bands.

1.8 1.8.1 $P = \frac{M \times C}{R}$

$= \frac{18 \times 16}{6}$

$= 48\,(4)$

1.8.2 Rings don't harm the bird.
Rings don't fall off.
Rings don't make birds vulnerable to predation.
Rings don't make birds more likely to be recaptured.
(any 3)

1.8.3 (a) Quadrat

(b) Census

QUESTION 2

2.1 2.1.1 Competition/competitors/interspecific competition.

2.1.2 Species III

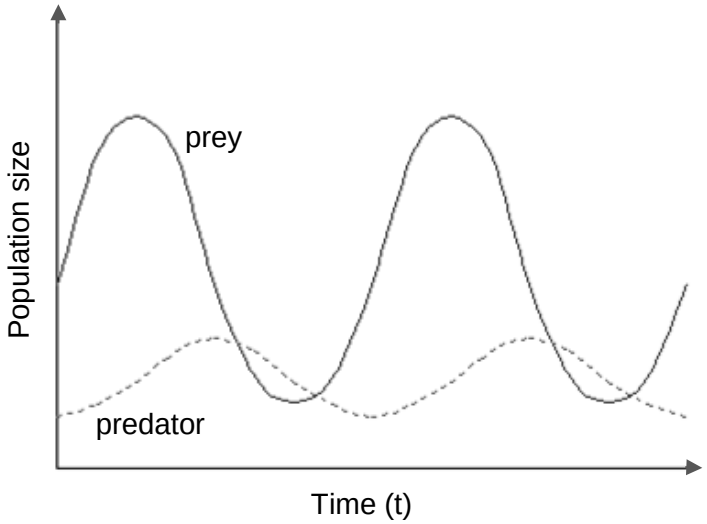
2.1.3 Tiger fish

2.1.4 Trout

2.1.5 35 – 40% of 200 = 70 – 80

2.1.6 same number of fish; same size of pond; same physical environment in pond; same method of sampling used to estimate tadpole populations/no interspecific competition between tadpoles. (any 3)

2.1.7



Heading: Graph showing predator prey fluctuation over time.
Axes × 2
Prey numbers higher.
Predator graph lagging behind prey graph.
Key/labels on graph for predator and prey.

2.2 2.2.1 Niche partitioning/Resource partitioning.

2.2.2 It allows them both to co-exist by reducing competition using resources differently with different niches/at different depths in same habitat.

2.2.3 Plants grow to different heights because they have different light requirements so they can exist in same area without competing. Canopy vs shrubs vs undergrowth, etc.

2.3 2.3.1 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 predators to focus.
(any 3)

2.3.2 Stripes break the outline so predator cannot form clear image of animal. In herds, all the stripes blend together so individuals cannot be singled out.

2.3.3 Large number of animals 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 ensuring successful kill.
Single breeding pair ensures that most of pack is in peak physical condition for hunting.
Nursemaids left to look after pup ensures that hunting pack are 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 2 concepts)

2.4 2.4.1 66 000

2.4.2 **Increase** in size due to largest number of individuals in 0 – 14 age group/ large number of individuals of reproductive age (15 – 45).

2.4.3 Fewer births due to education/contraception, so smaller base.
Less steep pyramid as larger number of older individuals surviving due to better medication/ nutrition.

QUESTION 3

3.1 3.1.1 Allopatric

3.1.2 Why? Two groups separated by canyon so no interbreeding. (max 2)
How? Each side of canyon had unique environmental pressures/different conditions occurred resulting in certain individuals that were better adapted to conditions to be selected/survive. They survived to reproductive age while the others died off. Over time the two groups became more and more different until they could no longer interbreed/became reproductively isolated. (max 4)

3.1.3 They were able to fly across canyon so kept interbreeding.

3.2 3.2.1 Predation.

3.2.2 The dark/grey mice are the 'fittest' as they were camouflaged/hidden by the colour of their fur in that dark environment so they were not captured by predators as easily as the white mice.

3.3 3.3.1 Co-evolution

3.3.2 Delicate mouth parts have evolved to be able to link mouth with ant mouth. Glands which produce sweet nectar have evolved to gain acceptance to ant colony/to prevent ants from killing them.

3.3.3 Sweet nectar to eat and assistance with digesting food/digested nutrients.

3.4 3.4.1 Small isolated community leads to inbreeding so more likely to inherit 2 recessive genes.

3.4.2 (a) Intermarriage will bring in healthy/dominant genes to mask the effect of the recessive mutations/increase gene pool.

(b) No – unique culture so should be preserved, not all Amish suffer from the conditions.

OR

Yes – not fair on children, health more important than culture, will alleviate suffering, it is an outdated religion.

3.5 3.5.1 ± 4 - 4.2 million years old

3.5.2 Mrs Ples/Taung child

3.5.3 2nd wave of *Homo sapiens* moved from Africa up into Europe and drove *neanderthalensis* to its extinction/they were outcompeted by *H. sapiens*.

3.5.4 It allowed the development of a larger brain which allowed for higher cognitive functioning (or any example of higher cognitive functioning). This gave man the ability to survive and outcompete all other hominids.

3.5.5 (a) Bipedalism

3.5.5 (b) Freed up arms for carrying/ protecting young.
Freed up arms for manipulating tools, etc.
Allowed them to see greater distances so could see dangers/ opportunities better.
Cooler body because not receiving direct rays of sun on whole body. (any 3)

QUESTION 4

4.1 4.1.1 (a) circular strand of DNA found in bacteria.

(b) DNA which has had a foreign piece of DNA inserted into it.

4.1.2 Restriction enzyme
Ligase enzyme

4.1.3 Less chance of rejection; fewer side effects; cheaper to produce (any 2)

4.2 4.2.1 (a) 2 normal individuals can have a child with Menkes/low expression in each generation.

(b) Only males have the disorder.

4.2.2 P1 phenotype: Normal male x Normal/carrier female
P1 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

F1 genotype: 1 $X^N X^n$: 1 $X^N X^N$: 1X^NY : 1X^nY
F1 phenotype: 1 carrier (normal) female: 1 normal female: 1 normal male: 1 Menkes syndrome male

4.2.3 25%

4.2.4 Yes – child will suffer/short life expectancy/financial strain (any 2)

No – early treatment improves prognosis/ethical issues with the right to terminate life.

4.3 4.3.1 Secondary succession

4.3.2 Pioneers will begin to grow. They prepare the soil for plants and then small animals. Grasses develop → shrubs. Larger animals move into area. Trees grow. Climax community.

4.3.3 (a) ± 170 to 190

(b) B – unlimited growth due to abundance of resources.
C – stable/no growth because environmental resistance prevents further growth/reached carrying capacity.

(c) 6 months

(d) Fire has invigorated vegetation so can now support larger numbers. Competitors have not returned so more resources available.

4.4 4.4.1 Type of sperm

4.4.2 Make sure results were reliable prevent isolated nuisance variables from affecting results.

4.4.3 Long-calling grey tree frog – its larva survived better/its larva grew better/it reached adulthood sooner.

4.4.4 It ensured that the genetically better adapted males' genes were passed on to next generation thus increasing species fitness.

Total: 200 marks