NATIONAL SENIOR CERTIFICATE EXAMINATION
SUPPLEMENTARY 2014

LIFE SCIENCES: PAPER I

MARKING GUIDELINES

Time: 2½ hours | 150 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 C G I H E A F (7)

1.2

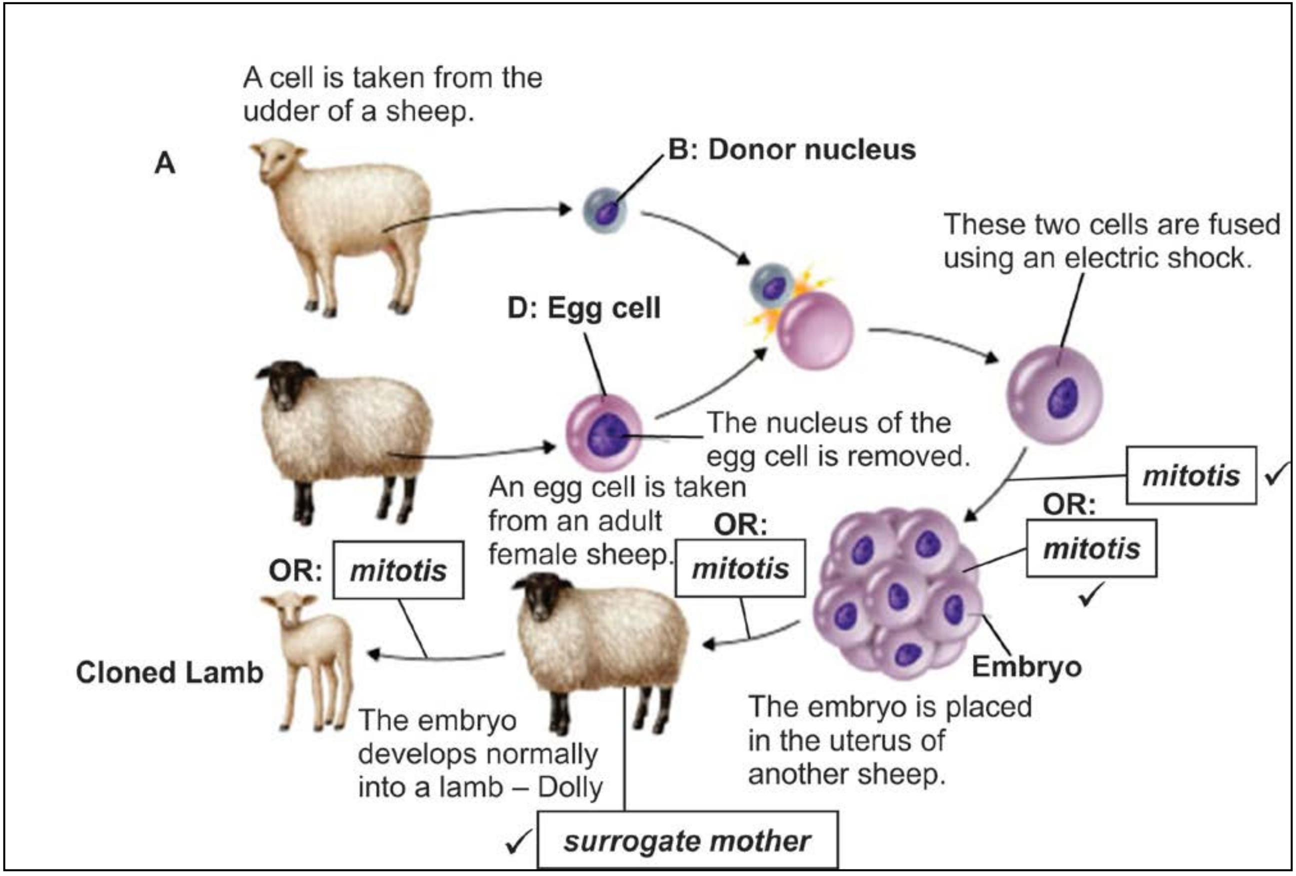
Statement	or X	Correction	
Mitochondrial DNA is used to determine maternal lineage.			
Sections of coding DNA are used to construct a DNA fingerprint.	**X**	Non-coding DNA	
The *Out of Africa* hypothesis states that *Homo erectus* migrated into Europe and developed there and in other locations into *Homo sapiens*.	**X**	multiregional	
t-RNA is a type of RNA that delivers amino acids to a ribosome during translation.			
Having two identical genes at the same locus is termed heterozygous for the characteristic.	**X**	homozygous	

(5)

1.3
- 1.3.1 A (1)
- 1.3.2 A (1)
- 1.3.3 D (1)
- 1.3.4 C (2)
- 1.3.5 C (1)

1.4 1.4.1
- (a) True (1)
- (b) False (1)
- (c) True (1)
- (d) False (1)
- (e) False (1)

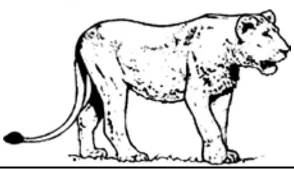
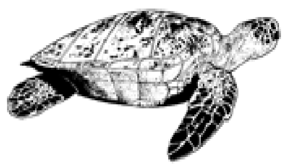
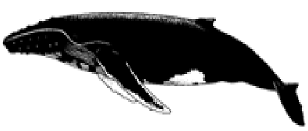
1.4.2 Labelling:



(2)

1.4.3 recreate/breed more animals with favourable/desired characteristic/trait (2)

1.5

Pairs of organisms	Convergent	Divergent	Reason for choice
(a)  			Related organisms evolve differently/evolve to occupy different niches *(or any other reasonable answer)*
(b)  			Unrelated/distantly related organisms independently evolve flippers/similar structures for swimming *(or any other reasonable answer)*

(4)

1.6 1.6.1 *Australopithecus africanus* *Homo sapiens* (2)

1.6.2 Taung child/Mrs Ples (1)

1.6.3 (a) *H. sapiens* has a foramen magnum directly underneath the cranium, Gorilla has foramen magnum towards back of cranium (2)

(b) *H.sapiens* skull indicates full bipedalism as foramen magnum underneath skull indicates vertebral column and girdles positioned directly below skull (2)

1.6.4 larger cranium size of *H.sapiens* indicates more well developed/larger brain /flatter facial region of *H.sapiens* finer features /smaller brow ridges of *H.sapiens* smaller jaw muscle attachment
(*other reason visible on diagrams)* (2)
[40]

QUESTION 2

2.1 2.1.1 (a) meiosis produces haploid gametes /halves chromosome no./genotype complement /increases genetic variation (2)

(b) 4 (1)

(c) diploid (1)

2.1.2 (a) DNA replication (1)

(b) chromosome helix unwinds DNA molecule separates between nucleotide base pairs each single strand of DNA acts as template free nucleotides in nuclearplasm pair up with complementary bases thymine with adenine guanine with cytosine link by hydrogen bonds between nitrogen bases two new identical DNA strands are formed process catalysed by DNA polymerase
6 good, relevant facts in correct order (6)

2.1.3 (a) homologous chromosomes/homologues/bivalents
(b) nuclear membrane/nucleus/nuclear envelope
(c) spindle/spindle fibres (threads) (3)

2.1.4 (a) two inner chromatids/any non-sister chromatids (other words describing this) of homologous chromosomes cross over at points of attachment called chiasmata chromatids break /pull apart and re-join with swopped sections of chromatids
(four points) (4)

(b) crossing over results in mixing of maternal and paternal characteristics/genes results in greater variation in offspring/gametes
Or other relevant facts about crossing over (3)

2.2 2.2.1 low sperm production in non-breeding seasons (May and Nov) /high sperm production in early summer/breeding season /amount of sperm produced changes in winter and early summer (*any two facts*) (2)

2.2.2 high levels of testosterone required for more sperm in early summer so that offspring have enough food to survive because testosterone levels low in winter offspring likely to die so sperm production low less energy expended on producing sperm
any suitable phrasing to illustrate the concept (4)

2.2.3 Sperm production in male Minks increases in the breeding season/summer and spring.
Statement
(Sperm production in minks decreases during the winter/non-breeding season) or (*other suitable statement*) (3)
[30]

QUESTION 3

3.1 3.1.1 variation in beak sizes environment changed due to pressure of drought shortage of small seeds some finches have favourable characteristic larger beaks selective advantage in eating larger, harder seeds more likely to survive and breed over time pass on genes for larger beaks/larger beak more frequent over time (*6 good facts*) (6)

3.1.2 (a) To investigate whether a shortage of small seeds results in a larger average beak size in (*G. fortis)* finches. (2)

(b) large seeds/shortage of small seeds/type of seeds (1)

(c) No/not a new species: small phenotypic change only /still interbreed
OR:
Yes – new species: if cannot interbreed with original members (2)

(d) Yes – established trend of increased beak size data to support evidence
Will stand up to peer review *or any other suitable reason*
No – only few years/short time period of investigation data would be minimal could have skewed results test during future/more drought periods *or any other suitable reason* (3)

3.2 3.2.1 continuous – beak sizes represented in a range (2)

3.2.2 many genes because continuous variation /all possible ranges of beak size from smallest to largest (2)

3.2.3 (a) 10,6 or 10,7 mm (1)

(b) (±)50 (1)

3.2.4 only takes short time for average traits to change traits change over time traits do not remain constant
Environmental pressures cause phenotypic changes
Favourable genes can be selected for
(*2 well explained facts*) (4)

3.3 Allopatric speciation geographic isolation members of tortoise population/same species become isolated by a geographic barrier such as lava flow etc. face different environmental conditions adapt to changes in habitat many small changes accumulate until two groups can no longer interbreed new species evolve (*any six facts*) (6)

[30]

QUESTION 4

4.1 4.1.1 mutated gene /change in (order of N-bases in) DNA gene that causes abnormal haemoglobin / sickle cells to be made (2)

4.1.2 Sickle cells are destroyed (1)

4.1.3 Sickling causes clumping and anaemia clumping can lead to failure in blood supply to organs organs become damaged e.g. brain damage can lead to paralysis /kidney failure /lung damage and pneumonia all potentially life-threatening ✓ (*4 good facts*) (4)

4.1.4 (a) HH (1)

(b) Parents HH X Hh OR

Gametes: H or H X H or h

	H	H
H	HH	HH
h	Hh	Hh

F_1 : HH HH Hh Hh / or: (1 HH : 1 Hh) (4)

(c) (i) 50% (Hh) (1)

(ii) (HH) 50% (1)

4.2 4.2.1 diploid (1)

4.2.2 in order for chromosomes to be visible must be coiled up / double stranded (2)

4.2.3 23 pairs Y chromosome present OR: X and Y present (2)

4.2.4 Homologous chromosomes malformed/ pieces missing or added/extra chromosomes e.g. trisomy 21 missing entire chromosomes (2)

4.3 4.3.1 placing healthy OTC gene into liver using virus/vector (3)

4.3.2 **many problems with the trials** many participants had side effects even if they were temporary or mild would indicate that therapy not fully safe yet preliminary studies on monkeys showed similar results to Jesse and 4 died **those running trials tried to keep adverse reactions and deaths quiet** deaths in other trials had not been reported before the trials no one had injected the adenovirus directly into the bloodstream trials not fully run (any other relevant facts from text) (*any six facts*) (6)

[30]

QUESTION 5

<table>
<tr><th>YES – NATIONAL DNA DATABASE</th><th>NO – NATIONAL DNA DATABASE</th></tr>
<tr><td colspan="2">History of DNA databases worldwide (use history of other countries to show trend of what is happening in developed countries)
Many countries have or are planning to implement a national database – example or precedent set.
Originally for crime.
Now considering database for disease, inheritance, etc./take blood at birth – question ethics of DNA use and laws to safeguard individual genetic identities.
SA – only some DNA of suspected and convicted criminals.
History indicates that countries with good database solve crimes more successfully.</td></tr>
<tr><td>Genetic diseases:
Determine presence of inherited diseases.

Solving crime:
DNA from blood, saliva, and sperm can be analysed.
Suspects can be linked to scene of crime.
Identify unrecognisable bodies – decomp, burnt, national disaster victims, genocide.
Respond quickly to disaster victims.
Matching suspects DNA if already committed a crime speeds up arrests.
Many repeat offenders in SA.

Paternity and identification:
Fathers/mothers identity can be confirmed.
Trace siblings, family members.
Trace missing children.</td><td>Right to privacy:
Innocent people's DNA may be linked to crimes.
Can trace family members of criminals and victimise.

Discrimination:
Genetic make-up can disadvantage people.
May be able to predict years in advance from a person's DNA if they are at high risk for disease.
This should be safeguarded and not be available to anyone.
May not be offered employment if carry genes that may cause debilitating disease.
Insurance companies, medical aid may refuse to insure.

Social and moral issues:
No one genotype should be regarded as better than another.
Time poll in USA – 74% did not want insurance companies to know genetic code and 84% did not want govt to know.</td></tr>
</table>

(an excellent essay would have 10 facts and 2 from beyond the sources)

Total: 150 marks

	1 mark	2 marks	3 marks	4 marks
Content: Thoroughness	• Up to 1/3 of potential detail in sources cited (**e.g**. 1 to 4 facts)	• About half of potential detail in sources cited (**e.g**. 4 to 8 facts from sources)	• All main topics in sources covered • About ¾ of potential detail in sources cited (**e.g**. 9 to 12 facts =11 + 1 original fact*) • One instance of significant information beyond the sources.	• All main topics covered • Source detail very close to full potential • At least (x) significant instances of information beyond the sources (**e.g**. 13 – 16 facts; 2 must be original & beyond the sources) = 11/14 + 2
Content: Relevance	• Mostly digression and/or repetition	• Around half is digression and/or repetition	• Repetition mostly avoided • Some minor digression • Argument relevant	• Isolated incidences of minor repetition • No digression. • Argument relevant
Supporting Argument i.e. <u>for</u>	• Writing consists of facts with little linkage or reasoning • Reasoning incorrect	• **<u>Maximum if no clear decision to support</u>** • Reasoning correct, but hard to follow • Ordinary; some linkage is evident	• Supports the position • Reasoning is clear • Minor errors in flow • Solid but not compelling; linkage sometimes missed	• Strongly supports a clear position • Reasoning is very clear and succinct • Flow is logical, showing evidence of clear planning • Compelling with regular use of linking language
Fairness i.e. Argument <u>against</u>	• One counter opinion given. •	• Two counter opinions given	• Three or more counter opinions given	
Position	• **Clear decision made**			
Presentation	• Writing is almost unintelligible • Tone, language and terminology unscientific and exceptionally weak • Introduction **and/or** conclusion **not** present	• Tone, language and terminology is weak • Attempts at correct paragraphing • **Introduction** and **conclusion** present, no matter how weak	• Tone is consistent and suited to scientific argument • Good and appropriate language and terminology • Mostly appropriate paragraphing • **Introduction** and **conclusion** have merit	• Tone mature and suited to scientific argument • Excellent and appropriate use of language and terminology • Correct paragraphing with good transitions • Interesting **introduction**, satisfying **conclusion**

[20]