



NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 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.

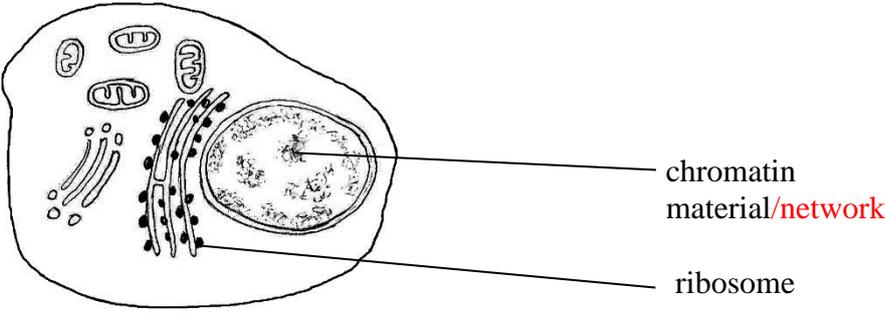
The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there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

1.1 C H D A I K E J B (9)

- 1.2 1.2.1 A
- 1.2.2 D
- 1.2.3 B
- 1.2.4 C
- 1.2.5 D
- 1.2.6 C
- 1.2.7 A (9)

- 1.3 1.3.1 translation (1)
- 1.3.2 A T C A T G 3 – 5 (1 mark) (2)
- 1.3.3 A U C (1)
- 1.3.4 peptide (bond) covalent bond (1)

1.3.5



The diagram shows a cross-section of a cell with various organelles. Two labels with leader lines point to specific structures: 'chromatin material/network' points to the nucleus, and 'ribosome' points to a small, dark, spherical structure in the cytoplasm.

(2)

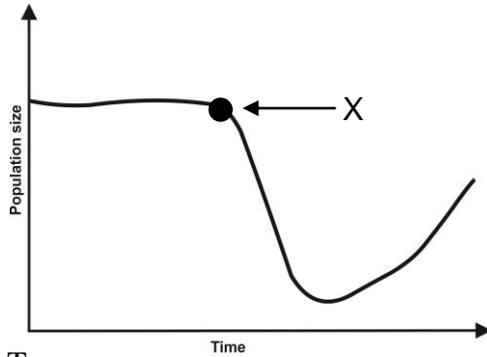
- 1.3.6 amino acid 1 = glutamic acid (1)
- amino acid 2 = proline (1)

1.4 1.4.1 they are different/not the same/different (male reproductive organ) structures/(species 1 to 6 have) different shapes/morphological difference/won't fit with female/male and female won't fit/pre-zygotic isolation/morphological difference (1)

1.4.2 can only mate/produce offspring/reproduce penis/reproductive organs only fits/matches different genitalia, fit/matches different female structures different shaped reproductive organs with female of same species different shaped penis/prevents locking AND with female of same species not with female of other species within species/it is species specific/between 6 different types/groups (2)

1.4.3 damselflies not separated by geographical barriers physical barriers live in same area AND separated by their physical features/different genitalia/body structure different; cannot physically reproduce/interbreed (offspring with other species); (speciation owing to) reproductive isolation/prezygotic isolation/mechanical isolation (2)

1.5 1.5.1



(1)

1.5.2 (a)

- (a) True
- (b) False
- (c) True
- (d) True

(4)

- 1.5.3 breeding programs/interbreeding/outbreeding with cheetah from other areas/
zoos select favourable genes/non-disease genes gene profiling explained to
increase genetic variation stronger cubs produced
Establish corridors to allow interbreeding with isolated populations
Educate/create awareness farmers/public to not shoot, hunt, poach
Wildlife conservation areas/game reserves, provide correct healthy
environment, no human development
Laws in place to stop hunting/poaching, secure area provided, penalties for
poaching/hunting
Research/study, why bottlenecks occur /to prevent another bottleneck
Ensure food/prey available/reduce hunting of their prey
Fundraising/collect money/donate money, for wildlife conservation, explain
specifically what
Vaccination against diseases, to prevent diseases, which the population is
susceptible too (gene profiling)
Artificial selection (must be explained), selecting favourable genes
Genetic engineering (must be explained)
(a combination of several of the above).
*2 strategies, one briefly explained/a well explained strategy/any other suitable
strategy/facts (3)*

[40]

QUESTION 2

- 2.1 2.1.1 male/boy presence of Y chromosome/XY/doesn't have two XX (2)
- 2.1.2 one of the pair of chromosomes number 5 is shorter/shorter arm on one
chromosome 5/one long one short chromosome 5/vary in length (2)
- 2.1.3 cat like cry respiratory problems small head round face small chin widely
set eyes folds of skin over eyes heart defects poor muscle tone difficulty
walking difficulty talking severe mental retardation /hearing problems/sight
problems/ poorly developed larynx (3)
any three

2.1.4 **Yes:** relief from uncertainty determine that it is an inherited disorder or not informed decisions about managing pregnancy/childcare/finances advice on possibly deciding to terminate a pregnancy explain how disorder originates provide valuable information on Cri-du-chat parents may be carriers so chances of child inheriting it are likely common disorder so could reappear in second child

No: religious objections deletion occurs in gonads during formation of gametes not all gametes/sperm/ova will have deletion cannot predict if a child will have disorder rather have IVF/amniocentesis/chorionic pre-implantation diagnosis when pregnant deal with disorder if present prepare for care of child ethically wrong to abort if child has disorder (4)

2.1.5 genes/nitrogen bases/nucleotides/section of DNA are missing/lost/sequence of nitrogen bases is changed no DNA code/genotype for a protein trait/characteristic/phenotype would be different, incorrect protein /amino acid sequence (2)

2.2 e.g. Sickle cell anaemia – mutation causes abnormal production of haemoglobin red blood cells loose shape/become spiky/sickle shaped malaria parasites cannot get inside sickle cells heterozygotes have advantage only some cells clump/distort some normal cells so not lethal

e.g. HIV – no marker lack of adhesion protein cannot gain entry to white blood cells resistant to HIV

e.g. Describe an example of benefits of evolutionary adaptation, e.g. finches, tortoises, olive baboon, giraffes, bipedalism, TB resistance, polyploidy in wheat/strawberries

Name and 2 good points which describes the benefit of the mutation (3)

2.3 2.3.1 Snowball = number 2 same/ similar width/type/size bands/matching bands (2)

2.3.2 to exclude cats that were in Beamish's neighbourhood as cat hairs easily stick to clothing could have come from another cat/make sure it was Snowball's fur to link Beamish to being with Duguay/more samples to make investigation valid (2)

- 2.3.3 (a) chromosomes/DNA/non-coding (junk) DNA (1)
 (b) semen; blood; skin, sperm, saliva, epithelium (any other suitable answer) (1)
- 2.4 2.4.1 **YES:** DNA profiles can be used to trace missing cats/hereditary disorders for pet owners/provide forensic evidence for crimes against pet owners/breeding programs for special types of cats/prevent inbreeding so cats don't have genetic disorders/a lot of people have cats so a worthwhile exercise/cats leave a lot of hair that sticks so easy to trace owner/way of linking human to crime without infringing on their human rights/SA has a high crime rate so worthwhile to collect evidence
OR
NO: SA does not even have a DNA database/establish DNA profiles first for humans/SA police not sophisticated enough to collect DNA evidence/use DNA database/ SA could use money required for DNA database on more pressing social/economic problems/a lot of stray cats so not reliable evidence/cats have a short life span so would need to update regularly
And any other suitable answers (4)
- 2.4.2 (a) obtained from mitochondria of cells passed down from mother to her offspring small sections of DNA found inside mitochondria (2)
- (b) high mutation rate more individuality/unique large amounts of genes does not undergo recombination maternal lineage (2)
- [30]

QUESTION 3

- 3.1 3.1.1 4 cells formed/at the end/one cell produced 4/two series of divisions/in photo G and H chromosomes are in 4 groups/4 groups of chromosomes in bottom row/Anaphase is taking place twice/equator is at 90°
(any other suitable answer) (1)
- 3.1.2 (a) A = parent cell/diploid cell/somatic cell/body cell/mother cell/germinal cell (1)
- (b) I = gametes/haploid cells/daughter cells/tetrad/egg/sperm cells/spore (1)
- 3.1.3 (a) A (1)
- (b) C (1)
- 3.1.4 crossing over/chiasmata form swop genes/sections of DNA/chromatids/chromosomes/paternal and maternal chromatids/bivalents/homologous chromosomes gametes different to parent's genes/ genotype random assortment/independent assortment chromosomes line up independently/randomly on equator when separate and move to poles unequal amounts of original maternal and paternal chromatids/ homologous chromosomes/genes/characteristics/different combination of maternal and paternal chromosomes/genes/characteristics mutations.
Importance: changes in genotype offspring has greater opportunity to be adapted in changing environment evolution relies on small changes in characteristics natural selection relies on variation
variation 4/5 + importance 2/1 (6)

- 3.2 3.2.1 (a) Selective breeding/inbreeding /artificial selection/outbreeding (1)
- (b) characteristics/features/outward appearance/phenotype/expression of genes/physical appearance/physical attributes (1)

3.2.2 resists mastitis placid avoids injury walks and stands comfortably few metabolic disorders shows when on heat conceives easily produces live calf without assistance maintains body condition on inexpensive feed first *any two* (2)

3.2.3 Table of differences between selective breeding and natural selection

SELECTIVE BREEDING/ ARTIFICIAL SELECTION	NATURAL SELECTION
1. Characteristics selected by farmers	1. Environmental pressures/changes in environment favour certain characteristics
2. Much quicker process – few years	2. Slower process – 100s to 1 000s of years
3. Farmers maintain desired genotype	3. Survival of fittest causes certain genotype to persist
4. Requires human intervention	4. Occurs naturally
5. Purposeful selection	5. Random selection
6. Predictable/known outcome (not for outbreeding)	6. Outcome unpredictable / unknown
7. Less variation (not for outbreeding)	7. More variation
8. Assistance needed	8. No assistance needed/environment dictates
9. Not necessarily for survival	9. For survival
10. Not necessarily fittest surviving/used for breeding	10. Only fittest survives/breeds

must have what was stated in 3.2.1 a

Column headings + 2 matching points *Other suitable answers* (5)

- 3.2.4 (a) $74 - 42 = 32$
Graph was altered in printing so these figures are incorrect
 $(74 - 78) - (36 - 38) =$ answer dependent on figures used in calculation
If figures are not in the above ranges but fall in the range of 70 – 80 and 30 – 40 and the calculation is correct the answer is credited with 1 mark (3)
- (b) 50 years
Graph was altered in printing so this figure is incorrect
47 – 50 years (1)

- 3.2.5 demand for more dairy to feed increasing population/greater milk yield better quality milk higher profits for farmers/increased productivity fewer cows are needed (2)
- 3.2.6 lower gene pool/reduced genotype increased incidence of malformations/mutations (not causes more mutations) increased susceptibility to disease sterility dysfunctionality increase in homozygosity decrease in hybrid vigour increase in vet bills expensive to breed reliant on human care increased infant mortality decreased life expectancy decreased size of offspring long process unpredictable results ethical issues eg killing unfavourable offspring
(accept examples of specific features; or 2 well explained reasons) (4)
- [30]

QUESTION 4

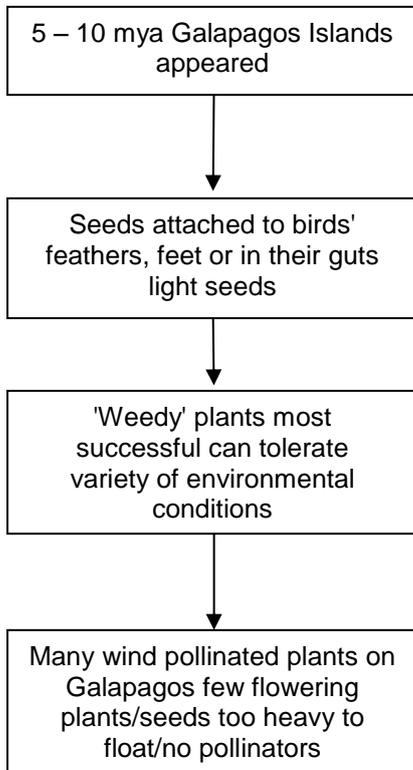
- 4.1 4.1.1 1 = Male/father/male symbol Bb and 2 = female/mother/female symbol bb
If numbers are not indicated, but answers in correct order e.g. male female (4)
- 4.1.2 (a) 5 brown : 2 white / 2.5 : 1 / 71,4% : 28,6 % (2)
- (b) 1 white : 3 brown offspring/white coated offspring produced; other parent has two white genes number 4 must have contributed a white recessive gene too. If 4 was homozygous then all offspring would be brown for offspring to be white, must have received a white fur gene from each parent. If use a punnet square, Bb bb (parents) and indicated which offspring was white or gave a verbal explanation (3)
- 4.1.3 egg cells/ova all with b/(white fur colour)/recessive allele (2)
- 4.1.4 (a) UV radiation/chemicals/herbicides/pesticides/viruses/pollution/
Mutagens/gamma rays/X-rays/smoke pollution/formaldehyde/
benzene/DDT/radiation/carcinogens (1)
- (b) more visible in wild not well camouflaged caught by predators more easily more susceptible to light damage/exposure to sun causing cancers (2)
- 4.1.5 (a) More desirable/cuteness/novelty value/sought after/by pet owners/
rare/greater profit/children like them/cleaner/represents purity (1)
- (b) recessive gene could become more prevalent/common/variety in
gene pool reduced/increase homozygosity/increase in recessive
disorders/closely related rabbits bred/inbreeding/reduced hybrid
vigour (2)
- 4.2 4.2.1 geographical isolation important in speciation/evolution islands have
different vegetation animals adapt differently/show different adaptations
eg. different finches/tortoises animals with mutation for favourable trait
reproduce more natural selection these animals increase in numbers mention
differences e.g. beaks adaptive radiation develop from a single ancestral
group/modification by descent can mention differences in habitat between
islands. Must give an observation of Darwin. If only natural selection etc.
discussed, max of 3 marks. (4)

4.2.2 (a) **Yes:** observe natural phenomena/plants and animals studied by Darwin greater development more sustainable local economy more jobs greater understanding of importance of islands development of wildlife services global awareness of environmental issues tourism major contribution to economy

No: pollution, e.g. rubbish threat from introduced pests, e.g. pigs/dogs killing indigenous species/disturbance of plants and animals too fragile habitat/ecologically sensitive area need to preserve environment for students of evolution restrictions on fishing for locals mass immigration of people looking for jobs. Any 4 facts. May be a combination of positive and negative aspects. If the facts are expanded on in greater detail, marks are awarded for these.

(4)

4.3



(accept variations that are logical and accurate)
arrows + good points

Other facts that are accepted:

No plant or animal life, birds bring in seeds, wind brings in seeds, many grasses and ferns, organisms arrive through long distance dispersal

To get mark for arrow, facts must be in logical order as well

QUESTION 5

Is there benefit in scientists working together to find out more about the evolution of modern humans (Homo Sapiens)?

EXPANDED MEMO Q5

source	BENEFITS through collaboration	NO BENEFIT in collaboration
A	<ul style="list-style-type: none"> Berger collaboration – Open access to palaeontologists – improved quality of results Good finds are rare – can collect more evidence Berger sharing <i>A. sediba</i> findings – good example to scientific world Require lots of evidence from different times and place Berger’s approach inspired others to share 	<ul style="list-style-type: none"> Have to share noble prize with others/loose recognition Can be unreliable Methods must be scientific – no cheating will get through. No collaboration required as Science already has a good process to ensure accuracy, e.g. peer review etc. Findings in Europe – scientists not obliged to inform each other
B	<ul style="list-style-type: none"> Different disciplines can bring different ideas to the findings – more reliable results – can lead to greater discoveries, e.g. Nobel prizes/ success OR: Scientists with different skills and from totally different institutes can complement each other’s skills Yamanaka and Gurdon –lead to important discoveries 	<ul style="list-style-type: none"> Not required as most scientists are honest Scientists may not all get recognition Much work still needs to be done – plenty of opportunities for all Scientist divided on new findings – could hamper future progress on Hominids if they do not pursue own research What is intellectual property – great findings belong to scientists who discover them
C	<ul style="list-style-type: none"> More testimonies gathered from different people – more accurate results 	<ul style="list-style-type: none"> Allow prestige/money for country/could increase tourism and revenue for specific country
D	<ul style="list-style-type: none"> Shows that it is better to get other people’s ideas that may refute the person who discovered the fossils – more accurate results Much unknown about human family tree 	<ul style="list-style-type: none"> Fossils from the past/future research should focus on innovative scientific research – e.g. stem cells
E	<ul style="list-style-type: none"> Expose cheats/more difficult to cheat Peer review – validates results Whistle blowing – reports foul play Increased objectivity of method used to gain results Replication by others validates findings Testability – can use other scientists to test theory – validity increases Science has important rules/code of conduct that all must adhere to – ensure this happens Regulates findings Makes family tree info more certain as all data is scrutinised by all scientists working on hominids 	<ul style="list-style-type: none"> Human origins are not as important as, e.g. a cure for cancer – no rush to get accurate results Political intervention prevents collaboration – must pursue scientific opportunities for a country Creates jobs for countries economy Need to share success and financial gain Concerns around authorship of results – financial implications Loose recognition of info Ownership of find/data/fame/ego Concerns around intellectual property Hidden agenda – skews groups results/ ignores valid data
F	<ul style="list-style-type: none"> Compare alternate theories and new ideas are brought in from scientists around the world Fossil finds rare – need to share findings Without collaboration – fossil finds can be contradictory Ideas can be challenged/argued and ironed out 	

G	<ul style="list-style-type: none"> • Compare evidence from around the world to help validate ideas • All scientist have the same goal – • Decreases time of theories being put forward • No collaboration leads to inaccuracies 	
H	<ul style="list-style-type: none"> • Collaboration results in relevant studies 	
Own	<ul style="list-style-type: none"> • Some scientist believe that <i>A. sediba</i> is more homo than Australopithecus • Explanation of how different skills can help scientists. • Relating relevance of Human genome project to discovery of evolution of modern human' • Watson and Creek – DNA model • Climate change research has been collaborated • Can lead to increased funding for research • Can provide more jobs • Religious viewpoint • Science is fluid and changes • (Need to be open to all ideas) 	<ul style="list-style-type: none"> • Watson, creek vs Franklin – work stolen • Takes longer to publish results • Leads to conflicts in a group • Piltdown example – secrecy • Mendel – did not share - was successful • Japanese scientist – fudged results • Chinese – fake cloning • BCG and autism • If one person cheats whole group discredited • Security of evidence is concern • Too much pressure from group – leads to fabrication • (Need to be open to all ideas)

COLLABORATION IS IMPORTANT	COLLABORATION NOT REQUIRED
<ul style="list-style-type: none"> • Much unknown about human family tree • Should pool information for greater understanding • Science has important rules/code of conduct that all must adhere to • Will regulate findings: <ol style="list-style-type: none"> 1. Peer review 2. Regulation by authorities 3. Objectivity 4. Replication 5. Testability <ul style="list-style-type: none"> • This will make 'family tree' more certain as all data is scrutinised by all scientists working on hominids • Prof Berger sharing <i>A. sediba</i> findings; good example to scientific world • Yamanaka and Gurdon won Nobel prize for jointly discovering mature stem cells can be programmed – led to important research for therapeutic uses in humans – only owing to collaboration • Fossils so rare, important to share any findings • Without collaboration hominid findings are contradictory 	<ul style="list-style-type: none"> • Findings in Europe – scientists not obliged to inform each other • Scientists might not get recognition • Much work still to be done, plenty of opportunities for all • Scientists divided on new findings – could hamper future progress on Hominids if they do not pursue own research • What is intellectual property – great findings belong to scientists who discover them • Allows prestige, money for country where scientist residing – could increase tourism – revenue • Fossils are from the past – future research should focus on innovative scientific research, e.g. stem cells • Human origins are not as important as, e.g. cure for cancer • Political intervention would prevent collaboration – must pursue scientific opportunities for country • Creates jobs for economy

Memo will be expanded with input from marking panel.

- many extra facts to use from own knowledge re: SAGS
e.g. Franklin; Watson and Crick – structure of DNA.

	1 mark	2 marks	3 marks	4 marks
Content: Thoroughness	<ul style="list-style-type: none"> Up to 1/3 of potential detail in sources cited (e.g. 1 to 4 facts) 	<ul style="list-style-type: none"> About half of potential detail in sources cited (e.g. 4 to 8 facts from sources) 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Mostly digression and/or repetition 	<ul style="list-style-type: none"> Around half is digression and/or repetition 	<ul style="list-style-type: none"> Repetition mostly avoided Some minor digression Argument relevant 	<ul style="list-style-type: none"> Isolated incidences of minor repetition No digression Argument relevant
Supporting Argument, i.e. <u>for</u>	<ul style="list-style-type: none"> Writing consists of facts with little linkage or reasoning Reasoning incorrect 	<ul style="list-style-type: none"> <u>Maximum if no clear decision to support</u> Reasoning correct, but hard to follow Ordinary; some linkage is evident 	<ul style="list-style-type: none"> Supports the position Reasoning is clear Minor errors in flow Solid but not compelling; linkage sometimes missed 	<ul style="list-style-type: none"> 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>	<ul style="list-style-type: none"> One counter opinion given 	<ul style="list-style-type: none"> Two counter opinions given 	<ul style="list-style-type: none"> Three or more counter opinions given 	
Position	<ul style="list-style-type: none"> <u>Clear decision made</u> 			
Presentation	<ul style="list-style-type: none"> Writing is almost unintelligible Tone, language and terminology unscientific and exceptionally weak Introduction and/or conclusion not present 	<ul style="list-style-type: none"> Tone, language and terminology is weak Attempts at correct paragraphing Introduction and conclusion present, no matter how weak 	<ul style="list-style-type: none"> Tone is consistent and suited to scientific argument Good and appropriate language and terminology Mostly appropriate paragraphing Introduction and conclusion have merit. 	<ul style="list-style-type: none"> Tone mature and suited to scientific argument Excellent and appropriate use of language and terminology Correct paragraphing with good transitions Interesting introduction, satisfying conclusion

The above design grid will be used to assess the essay. The essay marking guidelines will be expanded in consultation with the marking panel at the standardisation meeting.

Total: 150 marks