NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2018

LIFE SCIENCES: PAPER II

MARKING GUIDELINES

Time: 2 hours 100 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.

SECTION A

QUESTION 1

1.1 1.1.1 A sequence of nucleotides/piece/section of DNA/order of nitrogenous bases on a chromosome coding for a trait/ polypeptide/protein.

1.1.2 Gregor Mendel did experiments to show how inheritance of characteristics/traits occurs, he discovered rules "factors" controlling characters for dominance and recessiveness of characteristics/traits, he was the first to show this. Discovered rules of segregation of genes and independent assortment of alleles for different characteristics by breeding experiments done on pea plants with contrasting characteristics worked out ratios of inheritance.

1.2 It occurs on the short arm of chromosome 22.

1.3 Met-Hb cannot be turned back into haemoglobin. Met-Hb accumulates, resulting in colour change of blood to blue/met-Hb is blue and therefore person looks blue.

1.4 1.4.1 F

1.4.2 F

1.4.3 T

1.5 1.5.1 Inheritance of a pair/two abnormal alleles results in the condition.
The strain of the blue colour disappeared as the allele spread to families where it was unlikely to be paired with a similar allele.
From pedigree – any example of children with condition and parents without condition (Luna Fugate)

1.5.2 Luna Fugate couldn't have it if it was sex linked as her father did not express it. Alva would have been affected as his mother would have passed affected X✓ if sex linked
It is on chromosome 22 which is an autosome / not on X or Y. It occurs on an autosome.

1.6 Gametes: B b B b (or show this on the Punnett square/genetic cross).
All genotypes correct; one to three genotypes correct (then phenotype is wrong).

	B	b
B	BB	Bb
b	Bb	bb

Phenotype: 25% chance of blue child.
75% chance of normal child (can also express as a ratio 1:3 blue : normal or fraction ¼ blue, ¾ normal).
If pupil has incorrect gametes (B B and b b for example, or if sex linked), carry error forward and mark Punnett accordingly; no marks for phenotype. (cannot break up phenotype into "normal", "carrier" and "affected". If they do, only one mark given for correct percentage/ratio of sufferer – 25%)

1.7 Substitution one nucleotide/nitrogenous base has been replaced with another/C replaced by T.

1.8 30 000/3 = 10 000 (accept 9 999 if they have taken into account stop codon not coding for an amino acid or 9 998 if they have also taken into account demethylation of protein after translation (removal of methionine brought by start codon).

1.9 1.9.1 "Fugates married other Fugates"
"Sometimes they married first cousins"
"They married the people who lived closest to them even if they had the same last name"
"All lived in isolation … It was natural that a boy married the girl next door."
"Martin Fugate's descendants … all over the area."

1.9.2 Yes – it is important to acknowledge the existence of the people. It is in the public domain already. Most people in the story are dead anyway, not judgmental about inbreeding.

No – there is a risk of discrimination. No evidence that consent has been given (consent needs to be given). Invasion of privacy.

QUESTION 2

2.1 2.1.1 Producing copies of an organism/of individual cells that are genetically identical to the original.

2.1.2 Modified genome/DNA of organisms made by either inserting/ combining foreign DNA or DNA that has been edited/changed to contain foreign DNA.

2.2 Polymerase chain reaction (PCR)

2.3 2.3.1 B

2.3.2 A

2.3.3 A

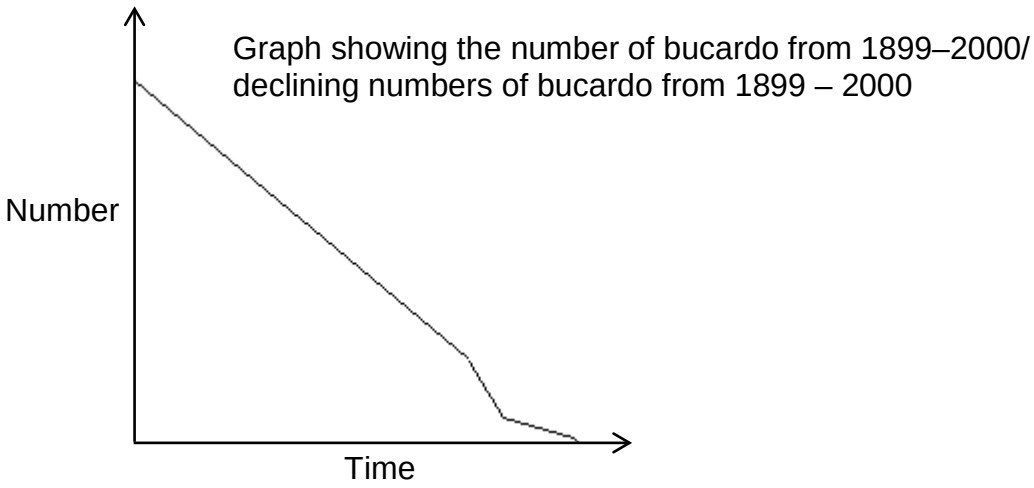
2.4 Frog DNA/genes codes for characteristics that are different to dinosaurs as the sequence of nucleotides is different./Genes are different in different organisms/therefore codes for wrong (frog) proteins.

2.5 2.5.1 GUG CUG AAU

2.5.2 Val – Leu – Asn

2.6 1/57 × 100 = 1,75% or 1.8

2.7



2.8 2.8.1 Diploid

2.8.2 Haploid

2.8.3 Meiosis

2.8.4 Nucleus

2.9

Ethical problems	Ethical benefits
Animals will be restricted to living in zoos/laboratories.	Bringing back animals may be beneficial for the environment.
Money should be spent on saving rare animals.	Our responsibility to bring back species we caused to go extinct.
CRISPR is potentially dangerous/ unethical to edit DNA.	Development of new techniques could benefit animals/humans in future.
They may be targets for hunters.	Can be used to save species from becoming extinct
May become extinct again – threats are still present.	Restriction of animals to zoos/ laboratories for their protection
Unethical to do this for the sake of seeing if it can be done.	
Problem with choosing which animals to bring back from extinction	
Health concerns for animals – dying soon after birth/breathing difficulties etc.	

SECTION B

QUESTION 3

There is good evidence for a genetic cause for transgenderism	
YES – Genetic: there is good evidence	**NO – not genetic: no there is not good evidence – other influences have more/ other evidence**
SOURCE A Can be genetic changes/mutations influencing transgender. X / Y chromosome differences Brains determine gender (therefore genetic). Cannot choose or change gender (therefore must have genetic basis. Gender is a continuous characteristic – therefore genetic. Gender set by age 4	**SOURCE A** Environmental (e.g. difference in brain structure)/psychological/societal/hormonal influences. Brains (our way of thinking) determine gender (therefore environmental issue). Takes 4 years to appear therefore must be environmental.
SOURCE B The higher percentage of identical twins who are both transgender supports a genetic origin 38% are transgender.	**SOURCE B** If genetic, then we would expect 100% of identical twins to be transgender if one twin was transgender, therefore not a genetic cause. Only 38% of identical twins both being transgender (low)
SOURCE C Common phase in adolescent life (Only SOME youth are "trying out" transgender – not explain all cases)	**SOURCE C** Common phase in adolescent life Youth are trying out transgender – most are going through a phase or other emotional reasons By puberty or adulthood most identify as their biological sex (most have outgrown gender confusion) Most children outgrow transgender. More transgender present simply due to increase in acceptance.
SOURCE D Gender is not the body we are born into (gender indicates a genetic component)	**SOURCE D** Gender is not the body we are born into Parents, family and friends, media role models, culture, learning and conditioning.
SOURCE E Studies based on very small sample size. Testosterone release may be influenced by genetics	**SOURCE E** Studies based on very small sample size. Differences in brain structure due to hormones. White matter pattern in females due to environment (therefore transgender activity changes brain structure) Long-term exposure to stress diet or drugs can alter brain structure.

SOURCE F Two decades of brain research (looking for evidence of genetic origin therefore there must be something to it) Transgender often occurs in children very early on, therefore unlikely it's environmental. CYP17A1 and CYP19A1 genes possible contenders. Unique alleles of RYR3 gene has been found in some transgender individuals. Male transgenders more likely than non-transgender to have different receptor gene for testosterone, therefore reduces testosterone action, also works less efficiently at communicating testosterone message to cells. masculinise/feminise Another study found differences in the ER beta gene resulting in a lack of oestrogen receptors in female transgenders.	**SOURCE F** Only 13 individuals have unique alleles of RYR.
SOURCE G	**SOURCE G** Substances (e.g. medicines/pesticides) that inhibit testosterone function known to feminise fish. Oestrogen mimics can cause feminisation of fish, found in chemicals such as the pill. Substances can enter through contaminated water
SOURCE H Foetal hormone insensitivity – AIH. CAH – genetic causes for hormones cause females to have male sex organs. Intersex	**SOURCE H** Foetal hormone insensitivity – AIH. Incorrect sex assigned at birth. Hormonal medications taken during pregnancy can affect genitalia development.

OWN: any extension of nature vs nurture.
Own experiences can be brought in if appropriate.
Genetic disorders – Klinefelters/Turners syndrome.
Epigenetics
Consuming hormone disrupters

Total: 100 marks

Note: Essay should be 2½ to 3 pages in length.
Time allocation suggestion: Reading of sources 10 min.; Planning 10 min.; Writing essay 40 min.

	1 mark	2 marks	3 marks	4 marks	Possible mark (40)
Planning **× 2**	• Decision given • Key points present for and against the argument	• Decision given • Key points developed for and against the argument	• Decision given • Key points developed for and against the argument • Source references identified (e.g. Source A/own information)		6
Decision	• Vague • Changed position within essay	• Clear decision made			2
Use of knowledge from sources **× 2**	• Up to ¼ of potential detail in sources used to support argument	• Up to ½ of potential detail in sources used to support argument	• Up to ¾ of potential detail in sources used to support argument	• Source detail – very close to full potential used to support argument	8
Use of own knowledge	• Some facts given beyond the source to support argument	• Many facts given beyond the source to support argument	• Some facts given beyond the source to support argument • Facts integrated into the argument	• Many facts given beyond the source to support argument • Facts integrated into the argument	4
Content Relevance	• Repetition mostly avoided • Some minor digression • Supporting argument relevant	• Repetition mostly avoided • Some minor digression • Supporting argument relevant • Quality of source extracts acknowledged			2

	1 mark	2 marks	3 marks	4 marks	Possible mark (40)
Quality of argument supporting decision × 2	• Writing consists of facts with little linkage or reasoning • Reasoning incorrect	• **Maximum if no clear decision in support** • Reasoning correct, but hard to follow • Ordinary: some linkage evident	• Supports the position • Reasoning is clear • Minor errors in flow • Linkage sometimes missed	• Strongly supports a clear position • Reasoning is very clear and succinct • Flow is logical • Compelling with regular linkage • Well-integrated argument	8
Fairness – counter opinions to decision	• One to two counter opinions given from the sources	• Three to four counter opinions given from the sources	• Integration of one to two counter opinions from the sources into argument	• Integration of three to four counter opinions from the sources into argument	4
Presentation	• Writing is almost unintelligible • Tone, language, terminology unscientific and very weak • Introduction **and/or** conclusion **not** present	• Tone, language, terminology weak • Introduction **and** conclusion present	• Tone is consistent and suited to scientific language • Good and appropriate language and terminology • Mostly appropriate paragraphing • Introduction and conclusion have merit	• Tone is mature and suited to scientific language • Excellent and appropriate language and terminology • Correct paragraphing with good transitions • Interesting introduction, satisfying conclusion	4
Scientific merit	Essay shows academic rigour, accurate reasoning, insight and cohesiveness.				2