NATIONAL SENIOR CERTIFICATE EXAMINATION
SUPPLEMENTARY EXAMINATION MARCH 2017

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

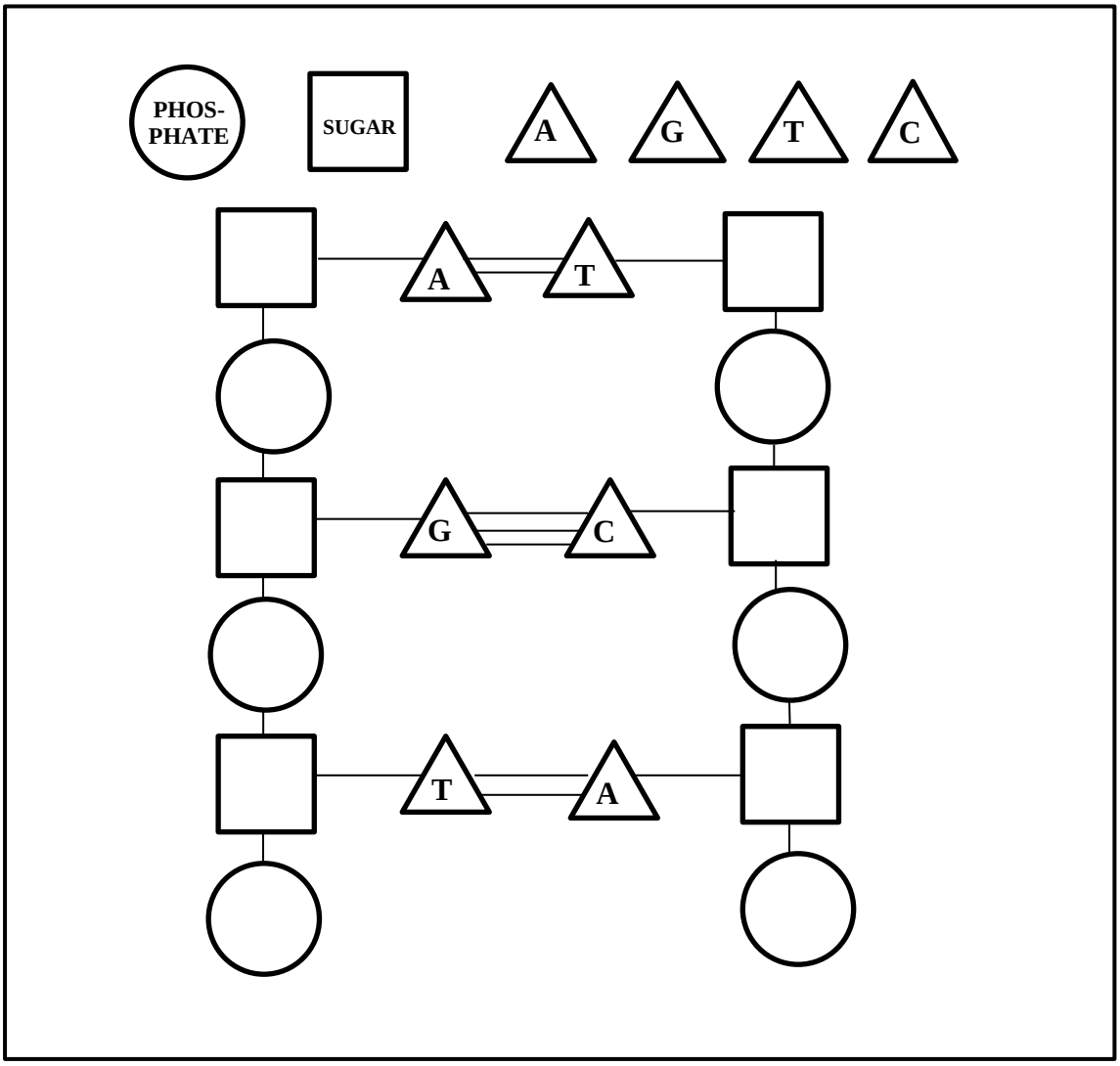
	COLUMN A		COLUMN B
[E]	This factor is manipulated in an experiment.	A	Hypothesis
[L]	A way to ask and answer scientific questions by making observations and doing experiments.	B	Dependent variable
[A]	A possible explanation for a natural event.	C	Apparatus
[H]	A statement following an experiment as to whether the results support the hypothesis.	D	Results
[B]	This is the factor that we are measuring.	E	Independent variable
[D]	A record of the actual outcome of an experiment.	F	Fixed variables
[G]	A statement that clearly indicates the purpose of the experiment.	G	Aim
[F]	The factors kept constant in an experiment.	H	Conclusion
[C]	Equipment used in scientific experiments.	I	Method
[I]	A list of steps to follow in an experiment.	J	Materials
		K	Scientific question
		L	The Scientific Method

(10)

1.2

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

1.3



S–P backbone alternating
Base attached to sugar
A–T and G–C pairing bonds joining complimentary bases (don't need exact number)
double S–P backbone (6)

1.4 Complete the following table on meiosis by filling in the blank spaces in the table:

Process	**During which phase/ stage of meiosis**	**Reason for the process**
Centromeres split	Anaphase II	To create single-threaded chromosomes/ daughter chromosomes in gametes/to ensure that half the chromosome number are in each daughter cell/gamete.
Crossing over	Prophase I	To create genetic variety in gametes.
Centromeres of bivalents repel	Anaphase I	To separate bivalents to create haploid cells/to halve chromosome number.

(6)

1.5

					F[1]					
H[2]	O	M	E[3]	O	S	T	A[4]	S	I	S
			N		H		D			
			D				R			
			O				E			
G[5]	L	U	C	A	G	O	N			
O			R				A			
I			I[6]	N	S	U	L	I	N	
T			N				I			
R			E				N			
E										

(7)

1.6 1.6.1

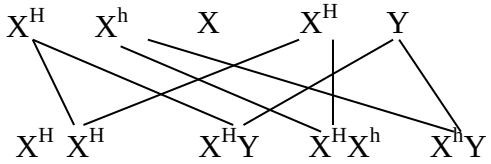
Number of the individual	Genotype
8	$X^H X^H$
4	$X^h Y$
6	$X^H X^h$
7	$X^H Y$

(3)

1.6.2 Genotype of Parents: $X^H X^h$ x $X^H Y$

	X^H	Y
X^H	$X^H X^H$	$X^H Y$
X^h	$X^H X^h$	$X^h Y$

OR



F1 genotype ratio: 1 $X^H X^H$: 1 $X^H Y$: 1 $X^H X^h$: 1 $X^h Y$
F1 phenotype ratio: 1 normal female : 1 carrier female : 1 normal male : 1 haemophiliac male.

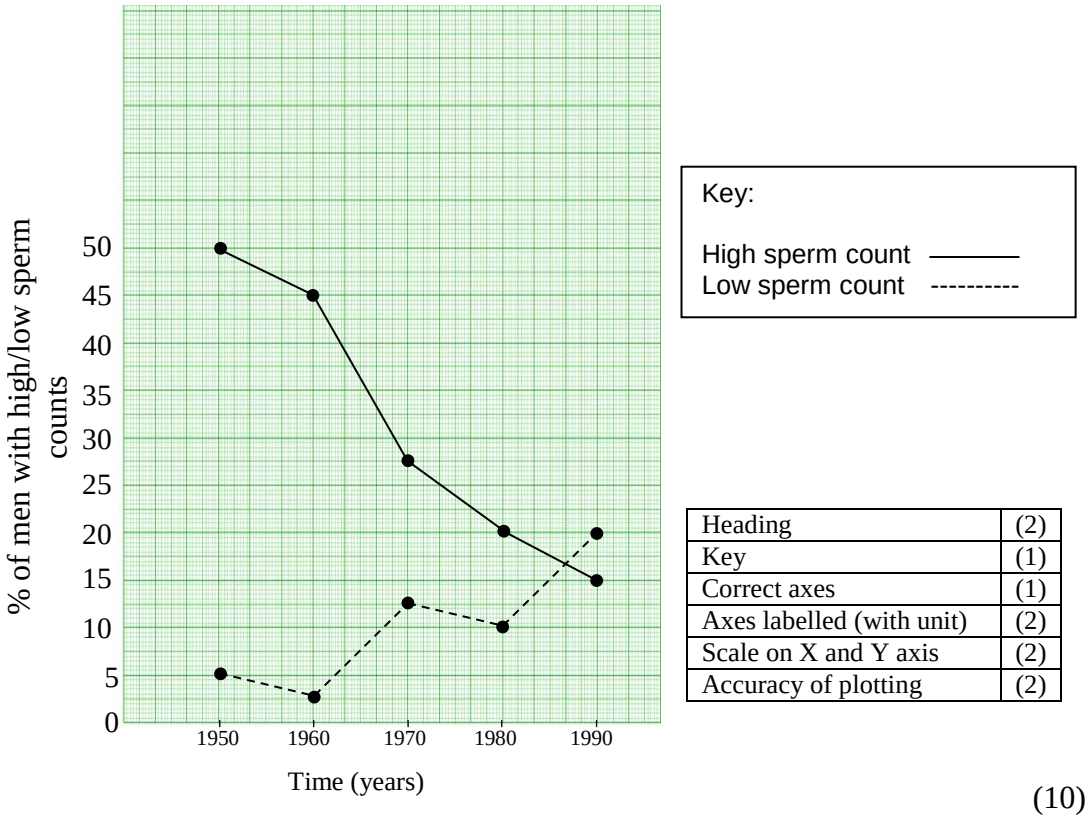
OR

F1 phenotype ratio: 2 normal females : 1 normal male : 1 haemophiliac male (6)

1.7 1.7.1 % men with high sperm count is steadily decreasing while % men with low sperm count is steadily increasing. (2)

1.7.2 Large amount of oestrogen in food / high levels of stress or any other reasonable answer. (2)

1.7.3 Heading: Graph showing the % of men with high and low sperm counts over a period of time.



Heading	(2)
Key	(1)
Correct axes	(1)
Axes labelled (with unit)	(2)
Scale on X and Y axis	(2)
Accuracy of plotting	(2)

(10)

1.8 1.8.1 (a) D / E (1)
(b) B (1)

1.8.2 A DNA
B mRNA
D Ribosome
E Polypeptide/Protein (4)

1.8.3 RNA Polymerase/Transcriptase (1)

1.8.4 Nucleus (1)

1.9 1.9.1 (a) True (1)
(b) False (1)
(c) True (1)
(d) True (1)
(e) False (1)

1.9.2 (a) Amniotic egg is waterproof/does not dehydrate.
Amniotic egg has yolk sac to feed developing embryo/foetus (2)

(b) Because it is waterproof it allows animals to move away from water and explore new habitats where water is limited. The developing embryo/foetus is better protected and sustained and thus chances of survival were higher. (4)

[80]

QUESTION 2

2.1 2.1.1 Down's Syndrome (1)
During meiosis homologous pair 21 do not separate in Anaphase I resulting in a gamete with 23 + 1/24 chromosomes resulting in a zygote with 46 + 1/47 chromosomes (3)

2.1.2 (a) Karyotype (1)
(b) A because there is 1 X and 1 Y chromosome so it is a boy. (2)

2.1.3 **Yes**
- because higher risk of Down's Syndrome in older women.
- because then she can terminate pregnancy if her child has Down's Syndrome.
- because it is too expensive to have a disabled child so if they have the test they can terminate pregnancy.
- make plans/prepare for child with disability. (or any other reasonable answer)

OR

No
- tests carry the risk of miscarriage.
- No reason to get tested – there is no need to terminate as Down's is a manageable disability (or any other reasonable answer) (2)

2.2 2.2.1 The paternal mtDNA is found in the middle piece/tail of the sperm. During fertilisation only the head/nucleus of the sperm enters the egg thus no paternal mtDNA forms part of the zygote. Only maternal mtDNA, which is present in the ovum, will become part of the zygote/embryo/ child/as any paternal mtDNA would be destroyed by ovum. (4)

2.2.2 It does not mutate very quickly (much slower than nuclear DNA) and so remains unchanged from generation to generation. (2)

2.2.3 **Table of comparison between mtDNA and nuclear DNA** (Heading)

	mtDNA	Nuclear DNA
Length of DNA	Short	Long
Number of genes	37	20 000+
Arrangement of DNA	Circular	Double helix
Location of DNA	Mitochondria	Nucleus
Rate of mutation	Low	High

Table format correct

(8)

2.3 2.3.1 A crop whose genome/DNA has been manipulated/changed/modified artificially to produce a desired outcome. (2)

2.3.2 The plant on the right has been genetically manipulated to secrete pesticides/insecticide so that insects/pests don't feed on it. The plant on the right is a "natural" plant still being eaten by insects. (3)

2.4 2.4.1 **Yes**

- they have had FDA approval so are safe to eat.
- they don't brown so will be more appetising for longer when cut.
- they don't brown so will lead to less wastage.

OR

No

- they have not been on the market long enough to see if there are side effects.
- not right to tamper with nature, should only eat things in their natural form.

(Or any other reasonable answer.) (2)

2.4.2 (a) Type of apple (2)

(b) % brown (2)

(c) **Yes** because the % brown was much less in Arctic Apples.

OR

No they said it does not brown but there is still some brown. (2)

(d) Environmental conditions/Time exposed/Method of slicing or any other reasonable answer. (2)

(e) Repeat experiment/perform experiment on a number of apples/allow a longer time period in the experiment. (2)

[40]

QUESTION 3

3.1 3.1.1 (a) A mature follicle containing an ovum found in the ovary of a female. (1)

(b) Remains of follicle after ovulation, which continues to secrete hormone. (1)

3.1.2 Slow increase in diameter from day 0–16 under the influence of FSH and then sudden, steep increase. (4)

3.1.3 Ovulation (1)

just after Day 20 the diameter decreases sharply indicating that follicle has ruptured. (2)

3.1.4 FSH causes the follicle to mature, growing in size.

LH causes the follicle to rupture, thus decreasing in size. (4)

3.1.5 (a) Oestrogen this causes the endometrium to begin building up/ thicken. (2)

(b) Progesterone this maintains/vascularises/glandularises the endometrium. (2)

3.1.6 Empty follicle started to decrease in size – if pregnant it would maintain size. (2)

3.2 3.2.1 (a) G

(b) E

(c) F (3)

3.2.2 Photograph Size = 75–78 mm Actual size = 12 mm

Mag = Photo size/Actual size

$= \frac{\text{From 75–78}}{12}$

= 6.3–6.5 (if unit given –1) (if not rounded to 1 decimal place –1) (4)

3.3 3.3.1 (a) Amniotic fluid (1)

(b) Protects baby from mechanical damage/shock absorber/supports embryo.
Protects baby's skin from dehydration/desiccation.
Allows unrestricted growth and movement of foetus.
Regulation of temperature. (3)

3.3.2 If a pregnant woman was over the age of 35.
If a genetic mutation is suspected.
If there is a family history of genetic abnormalities. (2)

3.4 3.4.1 Asexual reproduction is a type of reproduction by which offspring arise from a single organism. It does not involve fusion of gametes/offspring is genetically identical to parent. (Any 2 facts) (2)

3.4.2
- Does not change genotype, so if you have a good gene combination, all offspring will be same.
- Does not rely on pollination – only uses its own cells
- Fast/energy efficient. (Any 2)

3.4.3 **How:** Farmer will take seeds from well-adapted plant and use them to grow new crop OR artificially pollinate from 2 well-adapted parent plants to produce good seeds from which will grow crop. (2)

Why: Sexual reproduction produces variety. Climate change fairly quickly. Some will be better adapted to new climate conditions. (2)

[40]

QUESTION 4

4.1 **Variation** comes about because of mixing of genes and mutation meaning that all individuals in a population are not identical. Some individuals will be better suited to the environment and so when there is competition nature will **select** those individuals to survive and reproduce. Through reproduction the next generation will **inherit** the desirable genes and the unsuitable genes will not be passed on. Eventually the entire population will have changed. (6)

4.2 4.2.1 Long neck allowed then to reach higher vegetation because it was sparse on ground. Also saddle in front allowed neck to be lifted higher. (4)

4.2.2 On the small dry islands there were a variety of neck length and shell shapes. When it got dry and the low veg. dried up the short-necked, dome-shelled tortoises would not have been able to feed so they would have died while the long-necked, saddle-shelled tortoises would have been able to reach higher vegetation and they would have survived to reproduce and pass on their genes to the next generation. Over time the entire population would have had the long-necked, saddle-shaped shells. (5)

4.2.3 Natural selection/Survival of the fittest. (1)

4.3 4.3.1 Species is a group of organisms that are able to interbreed and produce viable or fertile offspring. (2)

4.3.2 Allopatric/Geographic Speciation. (1)

4.3.3 (a) They have a recent common ancestor and belong to the same genus. (2)

(b) They have adapted to their unique environments as they all live in different areas with slightly different conditions. (2)

(c) They cannot fly and live far apart on mountains means that they cannot breed with each other and thus the gene pools remain separate and evolve independently. (3)

4.3.4 **Different breeding season**: they are not "fertile" at the same time thus can't breed together.
Behavioural isolation: courtship behaviours differ and so they are not attracted to the other species.
Adaptation to pollinators: the same pollinators visit the same species preventing cross-pollination.
Different reproductive structures: make mating impossible. (2 × 2)

4.4 4.4.1 They are bipedal/foramen magnum close to middle of skull.
They have developed higher cognitive function.
They are able to make tools (or any other feature/behaviour). (2)

4.4.2 Many international tourists visit the area bringing foreign currency into the country.
Many jobs have been created to support the tourism industry. Access to funding for research. (2 × 2)

4.4.3 Used tools as the hand and wrist are complex/like humans.
Able to grip things as have opposable thumbs.
Still climbed in trees a lot hence the long, curved fingers. (2 × 2)

[40]

Total: 200 marks