



NATIONAL SENIOR CERTIFICATE EXAMINATION  
NOVEMBER 2019

**LIFE SCIENCES: PAPER I**  
**MARKING GUIDELINES**

Time: 3 hours

200 marks

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**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.**

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**QUESTION 1**

1.1

- |       |  |   |                 |
|-------|--|---|-----------------|
| [ K ] | causes contraction of the uterine muscle during birth  | A | ADH             |
| [ F ] | secreted by the adrenal gland during times of stress   | B | thyroid         |
| [ I ] | the disorder caused by an over-secretion of growth hormone   | C | homeostasis     |
| [ A ] | a hormone that stimulates the reabsorption of water in the kidney to reduce the water content of urine | D | prolactin       |
| [ B ] | gland located below the larynx   | E | goitre          |
| [ H ] | releases TSH when thyroxin levels decrease   | F | adrenalin       |
| [ C ] | process of maintaining a stable internal environment   | G | glucose         |
| [ L ] | an event that is triggered by high levels of LH  | H | pituitary gland |
| [ D ] | stimulates the production of milk in the mammary glands  | I | gigantism       |
| [ E ] | a condition caused by a lack of iodine in the diet   | J | dwarfism        |
|       |  | K | oxytocin        |
|       |  | L | ovulation       |

1.2

Question	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6	1.2.7
Answer	C	A	B	A	D	C	B

1.3 1.3.1 cross / transverse

1.3.2 transports nutrients / glucose transports O<sub>2</sub> transports CO<sub>2</sub> transports urea / waste products (any 2)

1.3.3 obtain stem cells for medical use to treat disease later on / treat genetic disorders / store for later medical use Accept other suitable answers, e.g. stem cells are undifferentiated.

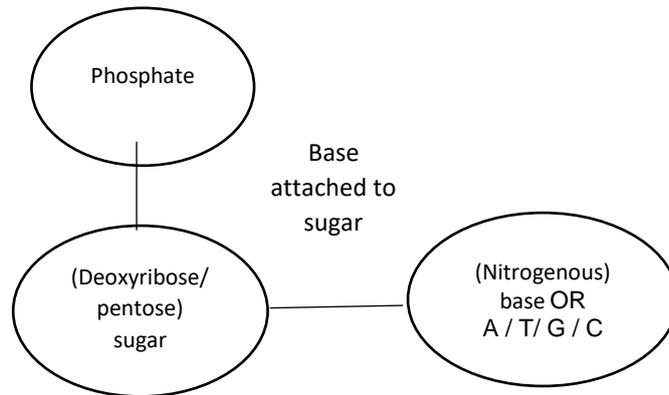
1.3.4 distance on page = 50 mm Divide 50 mm by 5 mm = x10  
Check answer on final printed copy.

Acceptable range: 47-54 (mm)

Magnification range: 9.4–10.8

If given measurement in cm (correctly measured) then max 1 mark.

- 1.4 1.4.1 A – uterus/ myometrium  
 B – amniotic fluid/ amniotic cavity  
 C – cervix  
 D – vagina
- 1.4.2 on diagram: extend from placenta to centre of abdominal area of foetus
- 1.4.3 acts as shock absorber/ protects foetus from mechanical impact  
 maintains foetal temperature allows free/ easy movement of foetus  
 allows symmetrical musculoskeletal development (due to pressure of fluid)  
 foetus practises breathing movements by inhaling liquid  
 practises swallowing of liquid swallowing amniotic fluid helps in formation of gastrointestinal tract prevent dehydration (any 2)
- 1.5 1.5.1 carries genetic code for making proteins proteins critical to control metabolism  
 can replicate itself to pass genetic code onto daughter cells / carries hereditary information to continue species all living organisms contain DNA (max 1 mark) (any 2)
- 1.5.2 Structure of one DNA nucleotide



(shape of molecule not important) If more than one nucleotide was drawn, then max one mark if base attached to sugar shown

- 1.5.3 3 adenine = 3 thymine total of 6. 16 – 6 = 10 guanine and cytosine  
 Therefore 5 guanine Reasoning process marked
- 1.6 1.6.1 N – mRNA / messenger RNA Z – codon / triplet / 3 bases  
 P – nuclear membrane / double nuclear membrane
- 1.6.2 transcription
- 1.6.3 polymerase / RNA polymerase

- 1.6.4 (a) ribosome / cytoplasm
- (b) peptide
- (c) GGC
- (d) substitution C was replaced with an A

1.7

	<b>Statement</b>	<b>A, B or C</b>
1.7.1	eDNA from sharks can be sourced from reproductive cells.	A
1.7.2	Collection of eDNA from sharks requires direct contact with the shark.	B
1.7.3	The zebra shark was identified using only one method of sampling.	B
1.7.4	The lack of eDNA from the tiger shark indicates that the shark was never in the area.	C
1.7.5	eDNA can replace other methods of identifying sharks.	B
1.7.6	According to the results in the table, using eDNA is more effective than using human divers to identify the presence of sharks.	A

1.8

<b>Item</b>	<b>Term</b>	<b>Answer</b>
1. Used as a vector to carry foreign genetic material into another cell 2. Circular DNA strand	Plasmid	C
1. Production of insulin in bacterial cells 2. Introduction of normal genes into cells to replace defective genes	Gene therapy	B
1. Cell having more than two sets of paired chromosomes 2. Producing exact genetic copies	Cloning	B
1. A powerful tool for editing sections of DNA 2. Used only in gamete cells	CRISPR	A
1. Determining the genomes in many different species 2. Altering of human genome by transferring genes from another organism	Human Genome Project	D

1.9

Description	Letter of diagram
Crossing over is occurring.	B / C
DNA replication is taking place.	A
Chromatids have separated and are moving to opposite poles.	G
Haploid gametes are formed.	H
Homologous chromosomes separate and move away from one another.	D

1.10 1.10.1 Total number of elephants counted = 20  
 $20 / 8 = 2,5$  average number of elephants / quadrat  
 $2,5 \times 200 / 20 = 275$

1.10.2 large enough to view / few of them / easy to see

1.10.3 gives a representative sample allows drawing of conclusion

The population is not distributed evenly shows no bias true reflection/ better or more accurate estimation, etc.

1.10.4 (a) development of young inside body of mother / young born alive rather than from eggs placenta nourishes young

(b) produce fewer offspring extensive parental care most young survive to adulthood late onset of maturity long gestation period of elephants (max 2)

**QUESTION 2**

- 2.1 2.1.1 uterus / lining of uterus
- 2.1.2 place where embryo is implanted / nourishes embryo / forms placenta
- 2.1.3 breaks down and leaves body as menstrual flow
- 2.1.4 During the course of the menstrual cycle the endometrium thickens.
- 2.1.5 oestrogen progesterone
- 2.1.6 Every woman's menstrual cycle may differ in length / illness or stress can affect menstrual cycle therefore ovulation may occur at different times / days data has been calculated from an average (any two)
- 2.1.7 test normal / natural menstrual cycle / oral contraceptives contain hormones / progesterone / oestrogen that would affect menstrual cycle / endometrium thickness
- 2.1.8 volunteers used participants give informed consent study should not affect health / dignity participants remain anonymous women tested for pregnancy first Accept other reasonable suggestions e.g. they should not be harmed women must be aware of parameters of the study (max 2)
- 2.1.9 dealing with human subjects/ living organism right to have privacy respected have right to decide whether to be involved in study sensitive tests so respect dignity Accept other reasonable suggestions (max 2)
- 2.1.10 endometrium would get thicker / remain thick / would not break down / become more vascular
- 2.2 2.2.1 testosterone
- 2.2.2 Males also have a (shared) responsibility for contraception not all women can safely use hormonal contraceptives can create a platform for gender equality Accept other reasonable suggestions e.g. it stops sperm / gamete production / effective temporary (reversible) measure / another alternative male contraception (more choice)
- 2.2.3 safety in use, e.g. safety trials effectiveness as contraceptive side-effects determined Accept other reasonable suggestions, e.g. does sperm production return to normal when stop using does not protect men from STIs
- 2.2.4 Flow diagram to show negative feedback in sperm production  
low testosterone → pituitary gland releases more LH (ICSH) and FSH → more testosterone released → sperm production stimulated (any 4 points in correct order ) arrows in flow diagram heading

- 2.2.5 condom mechanical barrier, traps sperm, placed over penis during intercourse **OR** vasectomy prevents sperm release by cutting sperm duct / vas deferens **OR** withdrawal remove penis before ejaculation
- 2.3 2.3.1 produce sperm / gametes / spermatogenesis
- 2.3.2 as age increases the larger the testis volume the greater the length of seminiferous tubules
- 2.3.3 440 – 460 m Check answer on final printed copy
- 2.3.4 Yes sudden increase in testis size / seminiferous tubules  
No, at age 10–12 testis size/ volume/ seminiferous tubules increases
- 2.3.5 penis enlarges growth of pubic hair deepening of voice growth in body size hair growth on face / underarms enlargement of skeletal muscles and broadening of shoulders acne (max 2)

**QUESTION 3**

- 3.1 3.1.1 8
- 3.1.2 males have a Y chromosome or X and Y chromosome females have only X chromosomes
- 3.1.3 Diagram showing chromosomes of gamete (heading)



4 chromosomes in total (no matter shape or size)  
 all 4 chromosomes correct shape and size (proportion) / ✓ 2 – 3 chromosomes drawn with correct shape and size  
 chromosomes single stranded

- 3.2 P<sub>1</sub> X<sup>R</sup>Y x X<sup>r</sup>X<sup>r</sup> (can mark parent genotypes in Punnett square)

	X <sup>R</sup>	Y
X <sup>r</sup>	X <sup>R</sup> X <sup>r</sup>	X <sup>r</sup> Y
X <sup>r</sup>	X <sup>R</sup> X <sup>r</sup>	X <sup>r</sup> Y

F<sub>1</sub> 1 red-eyed female : 1 white-eyed male

If parent genotypes incorrect, carry error through and give 2 marks for Punnett square if done correctly with that error. If one error in the Punnett square, then one mark can be awarded. No marks for ratio.

- 3.3 3.3.1 (a) complete genetic material / complement / set of genes of a cell or organism
- (b) mutation only affecting one nucleotide
- 3.3.2 X-rays / radiation
- 3.3.3 If genetic mutations occur in sex cells of parent these can be passed to embryo / foetus / offspring would be found in all cells of embryo / foetus / offspring
- 3.3.4 exposure subjected to / presence of X-ray radiation
- 3.3.5 X-rays can also cause mutations in human DNA humans should only be exposed for a short time when doing X-rays developing foetus protected during X-rays sex organs protected during X-rays people working with X-ray equipment need to be protected mutations in DNA can result in disease. (max 4)
- 3.4 3.4.1 pancreas
- 3.4.2 glucagon insulin
- 3.4.3 transport hormones to target organs / deliver nutrients and oxygen to endocrine cells (max 2)
- 3.4.4 (a) when glucose levels are high detected by glucose meter sends message to pump insulin delivered into body / blood glucose levels decrease to normal / set point insulin no longer delivered when glucose levels low detected by meter insulin withheld (5 points in correct order)
- (b) small therefore easy to carry less visible for self-conscious teenagers constant monitoring of blood important for busy / active teenagers irresponsible teenagers fixed and automatic Accept any reasonable suggestions, e.g. low maintenance teenagers are always eating (max 4)
- 3.4.5 good (healthy) diet exercise lose weight vigilant of symptoms reduce stress (max 2)

#### QUESTION 4

- 4.1 4.1.1 greater number of (rows of) kernels larger head / cob softer kernels larger kernels (max 2)
- 4.1.2 natural variation present humans cross-bred plants that had desirable traits only offspring showing these traits used in next cross-breeding carried out over many generations
- 4.2 4.2.1 has genetic material/ DNA from another organism in its genome or foreign DNA or DNA not found naturally

4.2.2 May answer yes or no

**YES:**

- may have health side effects negatively impacting human health
  - reduces choice of eating GM food people have right of choice
  - playing God as transferring genes from one organism to another
  - crop may cross-pollinate with other plants producing pest resistant weeds
  - destroys biodiversity as removing insect from food chain
  - Allergens introduced long term health effects not known
- Accept other reasonable suggestions

**NO:**

- Transferred genes made of same components as other genetic material no foreign material
  - Many trials conducted before releasing to the public making it safe for human consumption
  - kills off pest / caterpillar eating maize increasing yield
  - reduces spraying of insecticides making it healthier for human consumption
  - using a natural toxin not adding new chemicals to ecosystem when growing
  - only kills targeted insect making it safe for use
- Accept other reasonable suggestions

3 x points with explanation for each

4.3 4.3.1 hunting as a pack hierarchy of individuals / high-ranking and low-ranking individuals co-operative decision making dogs gather together (max 2)

4.3.2 dominant breeding pair / alpha male and female prevent other members from breeding, fittest genes passed to offspring raising pups a group activity increasing pup survival rate care of sick / old a group activity increasing chances of living longer more numbers better chance of fending off predators  
Feed the pups/ elderly/ injured first increases survival

(2 x points each point discussed)

4.4 4.4.1 diurnal live in herds adults have large horns used for protection (max 2)

4.4.2 interspecific

4.4.3 food / grass water predators disease space availability of mates (max 3)

4.4.4 (a) population decrease more prone to predation at night / less access to water

(b) reduce hunting allow hikers only at certain times of day / year strict hiking trails reduce agricultural impact by having more reserves limited hunting season Accept other reasonable suggestions, e.g. limiting visitors to the area (max 2)

4.4.5 C more bands in similar positions / more bands in common

4.5 less developed

Two reasons: typical pyramid-shaped (triangular) graph high birth rate small numbers of elderly broad base and narrow apex low life expectancy

4.6 4.6.1 resource / substance found in natural environment / required for growth / survival

4.6.2 population increasing exponentially able to circumvent environmental resistance Accept other reasonable suggestions

4.6.3 population will continue to increase will eventually run out of resources causing our extinction surpass carrying capacity environmental resistance will increase (max 2)

**Total: 200 marks**