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NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2020
FORMERLY MAY/JUNE

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**

- | | | | |
|-------|---|---|---------------------------|
| [G] | Discovered the molecular structure of DNA. | A | Karyotype |
| [H] | Technology used in criminal forensics. | B | Mendel |
| [J] | DNA that does not provide instructions for making proteins. | C | Deoxyribose |
| [A] | Used to identify chromosomal abnormalities. | D | Chromosomes |
| [K] | A physical or chemical agent that alters genetic material. | E | Amino acids |
| [I] | Unit of heredity that transmits information from one generation to another. | F | Polymerase chain reaction |
| [F] | Makes many copies of a small section of DNA. | G | Watson and Crick |
| [C] | Type of sugar molecule found in DNA. | H | DNA profiling |
| [D] | Thread-like structures containing DNA. | I | Gene |
| [L] | Monomer of nucleic acids. | J | Noncoding DNA |
| | | K | Mutagen |
| | | L | Nucleotide |

1.2

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

1.3

1.3.1

Term/Description	Correct number
(a) Ligase enzymes are used	3
(b) GMO	4 / 5
(c) Restriction enzymes are used	1
(d) Plasmid containing only bacterial DNA	

1.3.2 Joining of DNA from two different sources/organisms

1.3.3 Pancreas

1.3.4 Diabetes

- 1.3.5 (a) Ductless gland that secretes hormones directly into the bloodstream to maintain constant internal environment in response to change in body (max 2)

(b)

	Cells secreting insulin	Cells secreting glucagon
Name of cells in islets of Langerhans that secrete the hormone	Beta	Alpha
Position of cells in islets of Langerhans	Inner part	Towards the outside
Fewer/more cells	More	Fewer
Glucose levels in blood that stimulate release of hormone	High	Low

- (c) Hormones travel in blood to target organs

1.4

Item	Term	Answer
1. Hormone secreted from the ovaries 2. Controls release of FSH through negative feedback	Progesterone	C
1. Stimulates ovulation 2. Secreted by the corpus luteum	Prolactin	D
1. Oversecretion of growth hormone 2. Common in children	Acromegaly	A
1. Target organ is the bladder 2. Controls the water content and the overall volume of blood	Anti-diuretic hormone/ADH	B
1. Maintenance of a constant internal environment 2. Endocrine and nervous system	Homeostasis	C

1.5

Description	Letter
A graph showing rapid population growth	B
A graph where the population is declining	C
A graph where the overall female population is smaller than the male population	A
A graph representing a developed country	C
A graph that shows a high birth rate and a high death rate	B
A graph that shows a population with a long life expectancy	C

1.6	1.6.1		Statement	A, B or C
	(a)		The only threat to pangolins is poaching.	B
	(b)		The eight species of pangolin are all at risk of extinction.	A
	(c)		Seizures of poached pangolin products doubled between 2004 and 2013.	B
	(d)		Pangolins in Africa are at higher risk of being poached than pangolins in Asia.	C
	(e)		Pangolins are used in traditional medicine.	A

1.6.2 Place in reserves protection from poachers and human disturbance
safe place to breed

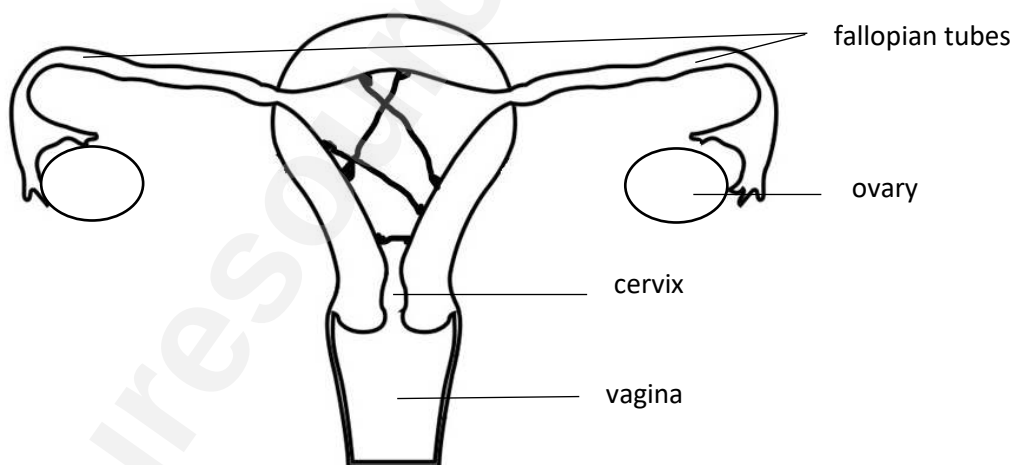
Place DNA of individual pangolins on data base if poached and
remains found allows for conviction of poachers act as a deterrent

Accept other reasonable suggestions

One practical suggestion why effective

1.7 1.7.1 Label on diagram (see diagram below)

1.7.2 position size (see diagram below)



1.7.3 Endometrium

1.7.4 Blocks cervix sperm cannot enter for fertilisation **OR** adhesions prevent implantation

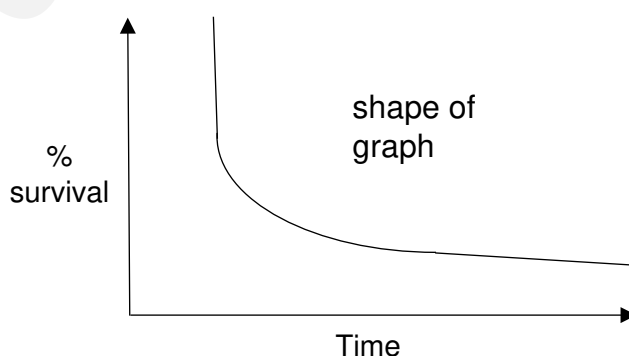
1.7.5 Yes no effect on ovaries/hormone production

1.8	1.8.1		Name of structure	Function
	A		Sperm duct/vas deferens	Pathway for sperm to leave testis/pushes sperm along via peristalsis
	B		Epididymis	Maturation of sperm/sperm storage
	C		Seminiferous tubules	Spermatogenesis/sperm production

- 1.8.2 (a) Secretes fluid aids transport of sperm/secreted enzymes to make sperm more active/muscles help to propel semen into urethra during ejaculation
- (b) 5 mm² (accept all values for whole month of Oct). Check answer on final printed copy
- (c) Jan/Feb – April
- (d) Increase in prostate gland size/prostate larger to provide secretions for semen

QUESTION 2

- 2.1 2.1.1 Transfer of pollen from anther to stigma
- 2.1.2 Pollen contains male gamete fertilisation can occur when male gamete fuses with female gamete in ovary which must precede seed formation (max 3)
- 2.1.3 Artificial light decreases pollination/seed production.
(Indicate two variables and the relationship between the two)
- 2.1.4 Time of year data collected type of flower size of area length of time data collected
- 2.1.5 Repeat study many times/study many cabbage thistle flowers to calculate an average/remove influence of outliers
- 2.1.6 To enhance growth of plants/crops restrict use of artificial light
Accept other reasonable suggestions
- 2.2 2.2.1 (a) F/False
(b) F/False
(c) T/True
(d) T/True
(e) F/Fals

2.2.2 Survivorship curve of the Bombay night frog

2.2.3 (a) Eat different foods

- (b) Increase in water beetles and snails as no frogs to eat them
Decrease in algae as increased water beetles and snails
Decrease in kingfishers as food source removed
Imbalance in ecosystem; degradation/collapse of ecosystem;
extinction of kingfisher
Two effects explanation for each

2.3 2.3.1 Adrenalin

2.3.2 Adrenal

- 2.3.3 Vasoconstriction of blood vessels to alimentary canal greater blood flow to heart and muscles
Increased blood sugar levels increase in energy release
Increase in heart rate blood carrying glucose and oxygen gets to muscles faster
Increased muscle tone faster or stronger muscles
Bronchioles dilated more oxygen taken in for respiration
Two effects and explanation of each

2.4 2.4.1 Pituitary

2.4.2 Thyroxin

- 2.4.3 Increase in metabolic rate
Healthy functioning of heart
Development of skeletal tissues
Development of nervous tissues
Regulate blood pressure

2.4.4 Elevated levels of thyroxin/hormone B not detected by pituitary gland/gland A pituitary gland continues to secrete TSH TSH travels in blood to thyroid gland stimulating production of thyroxin/hormone B
(Max 3 in correct order)

QUESTION 3

- 3.1 3.1.1 Dominant – need only one copy of allele to be affected
Autosomal – not located on a sex chromosome

- 3.1.2 (a) Man – Rr
Women – rr

(b)

	R	r
r	Rr	rr
r	Rr	rr

50% chance of Marfan child 50% normal child (Can use ratio 1:1 or fraction)

If student has incorrect genotype from Question 3.1.2 (a) carry error forward and mark Punnett accordingly; no marks for phenotype.

- (c) Marfan syndrome has serious consequences for the child couple has 50% chance of having child with Marfan allows parents to make informed choice counsellor informs parents of chance of having child with Marfan syndrome
Accept any reasonable suggestions (max two)

- 3.1.3 (a) Change in structure of gene/DNA/order of nitrogen bases

- (b) Sudden change only occurring in the cells of the individual mutation not passed from parents/no mutation in gametes of parents 25% are new mutations (max 2)

- 3.2 3.2.1 (a) Complete set of genetic material/ genes/coding DNA present in a cell/organism

- (b) Insertion – addition of nucleotides/genes
Deletion – removal of nucleotides/genes

- 3.2.2 Yes.

No off-target effects indicating safety

Marfan has serious/life-threatening effects on child improves life quality for child

Ethical reasons child has right to have best quality of life

(Accept any reasonable suggestions)

OR

No.

Ethical reasons mistakes can happen

Relatively new technology/scientists may not be aware of unknown side effect

Change in one gene may have unknown effects on other genes

Embryo start of human life not ethical to play God

(Accept any reasonable suggestions)

Two reasons each with an explanation

- 3.3 3.3.1 Embryo – stage of development until 8 weeks/organs are being formed
Foetus – stage of development from/after 8 weeks/all organs are developed
- 3.3.2 Central nervous system/CNS
- 3.3.3 4–8 weeks
- 3.3.4 Placenta
- 3.3.5 Many organs well developed central nervous system well developed heart, arms, legs, ears developing identifiable as human (max 2)
- 3.3.6 Yes
Average number of drinks has decreased from 16.9 to 8.1 decreased by half by second trimester when women realised they were pregnant (can refer to actual figures)
OR
No
Average number of drinks only slightly decreased in first trimester from 16.9 to 16.0 alcohol can cause lots of damage in first trimester second and third trimester still have high level of drinks per week 8.6/8.1 drinks per week is still high(max 3)
- 3.4 3.4.1 Messenger RNA/mRNA
- 3.4.2 Single stranded contains uracil
- 3.4.3 Arrows
mRNA attaches to ribosome → tRNA collects amino acids from cytoplasm → anticodon of tRNA pairs with codon of mRNA → peptide bonds form between amino acids → tRNA collect more amino acids → until polypeptide complete
Five good facts sequentially

QUESTION 4

- 4.1 4.1.1 Started from volcanic rock bacteria and fungi first colonisers
- 4.1.2 Not many terrestrial plants not enough food/shelter (max 1)
- 4.1.3 Droppings from gulls increased nutrient levels in soils/gulls carried in seeds from other areas dropped onto island
- 4.1.4 (a) Natality mortality emigration immigration
(b) 1990 – 2011/2015

- (c) Limits space for breeding lack of resources such as food water
Increased disease

4.1.5 Allows scientists to observe process of succession without humans disturbing it
No removal of plants/animal disturbing food chain
No pollution to destroy natural habitat
No foreign diseases to destroy natural organisms
Control alien organisms that can be brought in which may outcompete indigenous organisms
(One suggestion explained)

4.1.6 Puffins fly quickly/cover large distances would not remain in quadrat for long enough

- 4.2 4.2.1 (a) Body cell/not a reproductive cell
(b) Identical copies of DNA/cells/organisms
(c) Taking on the role of carrying an embryo when you are not the biological mother
(d) Between two different species

4.2.2 Critically endangered would be a method to increase population numbers

4.2.3 Nuclear DNA came from the nucleus of somatic cell of a black-footed ferret mtDNA came from the cytoplasm of the donor ovum of domestic ferret (max 3)

- 4.2.4 (a) 78
(b) $5/22 \times 100 = 22,7\% / 23\%$
(c) No.
Very few offspring survive from the many embryos that were implanted using this process in all three species. Can use actual values from table to support answer.

OR

Yes.

Species closely related have similar chromosome numbers which increases the chances of success. Species to be cloned are all endangered making process worthwhile. Species donating ova are domesticated and easily accessible. Any extra individuals to species essential as critically endangered may be essential part of food chain and essential to replace in environment. Accept other reasonable suggestions (max 3)

4.3 4.3.1 To determine the entire sequence of the human genome./Identify all the genes of humans

4.3.2 Yes.

Pinpointing genetic cause of a disease allows for identification of therapeutic solutions

Better understanding of human evolution allows us to track lineages

Improved forensic science DNA evidence could provide information about individual

Emphasised importance of collaboration between scientists to collate all data/information

OR

No.

Ethical issues regarding confidentiality and privacy

Psychological stress genetic susceptibility does not indicate will get disease

Accept any reasonable suggestions.

Two reasons each explained

Total: 200 marks