



INTERNATIONAL SECONDARY CERTIFICATE EXAMINATION
MAY 2024

BIOLOGY: 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] Position of a gene on a chromosome.	A Mutation
[E] The phase of meiosis when crossing over occurs between homologous pairs of chromosomes.	B Polyploidy
[B] The heritable condition of possessing more than two complete sets of chromosomes in plants.	C Anther
[K] The disorder caused by nondisjunction of chromosome pair 21.	D Metaphase I
[A] Random, unexpected change in the genetic make-up of an organism.	E Prophase I
[D] The phase of meiosis when homologous pairs of chromosomes line up along the equator of the cell.	F Aneuploidy
[C] The male part of a plant where meiosis occurs to produce pollen grains.	G Locus
[J] The term for when a trait is determined by multiples genes.	H Alleles
[H] The alternative form of a gene.	I Telophase
[I] The phase of meiosis when four haploid gametes are produced.	J Polygenic
	K Down syndrome
	L Anaphase

1.2

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

1.3

1.3.1	1.3.2	1.3.3	1.3.4	1.3.5
B	B	C	A	A

1.4 1.4.1 Internal

1.4.2 They mate repeatedly / 14 times over three days.

- 1.4.3 They both strike each other with their paws
- 1.4.4 The female will urinate on bushes, trees and rocks when she is ready to mate. A male picks up this scent She will respond with yelps as the male approaches her.

Accept any three points

- 1.4.5 Female gives birth
Young born live
- 1.4.6 The mother hunts and tears open the meat so that the cubs can feed
OR
She moves the cubs to a new den every few days to protect them from predators
- 1.4.7 The period of development of the foetus within the uterus / how long it takes for the foetus to develop within the uterus before it is born.
- 1.4.8 They are more likely not related this will prevent inbreeding there will be more genetic variation

Accept any two

- 1.4.9 **Yes**
- Gives the cheetah population in India another chance to flourish
 - Cheetahs are on the brink of extinction in Africa this may give their population the opportunity to recover in a different location
 - Factors causing them to be endangered in Africa may not be prevalent in India
 - Increase genetic variation as cheetahs from different areas chosen
 - **Any other suitable answer**

No

- If they became extinct in India previously how do we know this won't happen again/conditions will be the same leading to extinction?
- Inhumane / cruel for the animals to be transported for such long hours
- Kept in captivity in India not natural
- Very different environmental conditions possible for them not to adapt
- **Any other suitable answer**

Yes / No – no mark

Accept any ONE of the above, well explained

- 1.5 1.5.1 (a) somatic cells
(b) PCR (polymerase chain reaction)
- 1.5.2 nucleus and mitochondria
- 1.5.3 **Yes**
- The elephant population is threatened / endangered and this will help to conserve their population.
 - Poaching is very high now this helps track poached elephants / poachers / areas of poaching / and helps to reduce poaching.
 - Hotspots can be identified and more security / police / patrol can be placed in these areas.
 - Important to know how many elephants are left/where they are/genetic history of each elephant/whether have genetic disorders so that there is more awareness about poaching / more awareness with regard to elephant populations / find treatment for genetic disorders ... etc.
 - ***Any other suitable answer***
- No**
- Waste of time, money and effort as poaching still continues
 - Will take such a long term to add all elephants to the database by then poaching would reach critical levels
 - Still need to collect more samples more money and manpower needed
 - More important uses for a DNA database for criminals/high crime rate, etc. and not high use of info for animals
 - ***Any other suitable answer***
- Yes / No – no mark**
Accept any TWO of the above, well-explained
- 1.5.4 mtDNA is only passed from mother to child cannot trace any elephants along the paternal line
- 1.5.5 (a) DNA/genetic profile; DNA fingerprint
(b) 2 and 8
- 1.5.6 (a) census / aerial photographs
(b) Don't need to look for the actual elephants easier to just find their dung / will be cheaper / quicker / safer, etc.
- 1.6 1.6.1 (a) Secondary
(b) previously used land / land was previously colonised / flooding will not wash away all the soil / some soil remains after flooding
- 1.6.2 weed / grass

- 1.6.3 (a) artificial selection
(b) plant cloning

- 1.6.4 (a)
- Farmers must select the maize plants that have large cobs with more kernels.
 - These plants must be cross-pollinated so that seeds can be produced.
 - Seeds must be planted to yield the first generation of maize plant with the desirable trait / large cobs with more kernels.
 - In this generation, farmers must discard plants that do not have the favourable trait / large cobs with more kernels.
 - Replant seeds that come from favourable plants.
 - Repeat this process for many generations until all maize plants produced will have the desirable trait / large cobs with more kernels.

Any 5 points

- (b)
- They can increase their yield therefore making more money.
 - Greater yield provides more food for their families / village.
 - Select desirable varieties more successful crop

Any other suitable answer

- 1.6.5 (a) C – style
D – stigma

- (b) (i) A
(ii) B

- 1.6.6
- Not natural
 - May be seen as unethical by some
 - Decrease in variation
 - Too expensive

Any other suitable answer

Accept any TWO of the above

- 1.6.7 $500 \times 150 / 30 = 2\,500$

QUESTION 2

- 2.1 2.1.1 apex
 2.1.2 translocation
 2.1.3 *pictus*
 2.1.4 prey
- 2.2 2.2.1 resource partitioning
 2.2.2 interspecific/competitive coexistence
 2.2.3
- Even though they sometimes hunted similar animals **(text)** they hunted at different times of the day **(own)**
 - Even though they sometimes hunt similar animals **(text)** they preferred to hunt in different habitats **(own)**
 - They mostly preferred different types of prey **(own)** e.g., lion preferred warthog and wild dog preferred bushbuck **(text)**
- Any one of the above well-explained
 One mark for using the figure; one mark for explaining using own knowledge***

2.3 Plants → bushbuck → wild dog

arrows face the correct direction / organisms must come from text

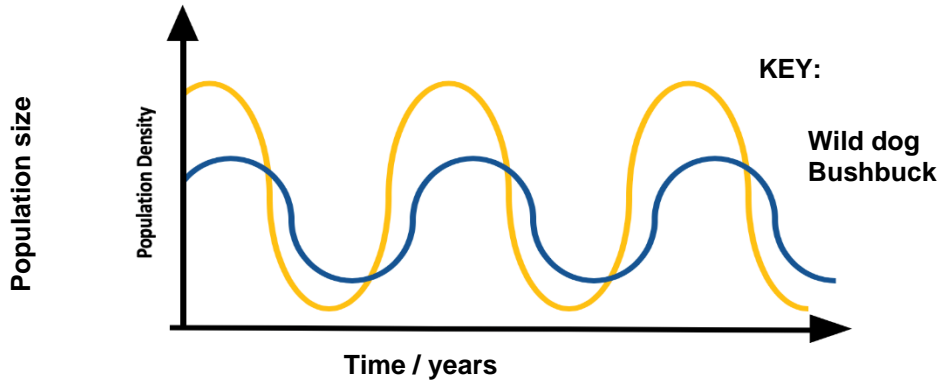
OR Plants warthog lion

(Can use any animal from the graph as the prey)

- 2.4 Decrease in wild dogs led to increase in bushbuck which destroyed / decreased / ate many plants
- 2.5 Not created naturally / created by man / had many different animals that were never in a pack before
- 2.6 Packs increased from one to four
 Number of dogs increased from about 13 to 50
 Between 2019 and 2020, more pups were born
- Accept any two of the above, must use the graph***
- 2.7 wild dogs would have hunted the farm animals and farmers would have killed them therefore reducing their numbers.
- 2.8 Those from established packs will not recognise the new pack and therefore struggle to integrate into the pack.
 They can become aggressive to the other members of the pack as they see them as a threat
 Solitary animals have no herd allegiance so will bond more easily
***Any other suitable answer
 Mark first well-explained answer or two listed reasons***

2.9 2.9.1 density-dependent as predator population will only increase if the prey population is high / there is more food available

2.9.2 **Sketch graph showing predator-prey relationship between wild dog and bushbuck**



Heading

y axis labelled

x axis labelled

key

both trends correct – bushbuck peak higher than wild dog and as bushbuck goes up wild dog then goes up and as bushbuck goes down then wild dog goes down

2.10 2.10.1 Warthog

2.10.2 0,10

2.10.3 waterbuck

- 2.11
- Hunting in packs ensures more success
 - Can target larger prey more food after a hunt
 - Packs mean some can hunt while others remain at the den to look after pups
 - Greater chance of survival in packs

Any other suitable advantage for social organisation

Mark first well-explained answer only

2.12 2.12.1 $62 / 111 = 55,85\% / 55,9\% / 56\%$

2.12.2 **Table showing the number of pups that survived over the 28-month time period**

Survival time (months)	Number of pups
3	62
6	23
12	23

all data entered correctly

QUESTION 3

- 3.1 3.1.1 (a) phenotype
 (b) The giraffe's entire set of genes / genetic makeup
 (c) amino acids

3.1.2 To identify mutations/diseases and find ways of treating them

OR

To identify where coding genes are located for scientific research purposes

- 3.1.3
- He was the first African geneticist to do this, so he could put his country, continent on the map
 - The Nelson Mandela Institute was fairly new this could mean recognition for the institution
 - Promoting Africa in science more countries would collaborate with African scientists / institutions
 - Role model for youth encourage study of science

Any other suitable answer

Mark first well-explained answer or two listed reasons

- 3.1.4
- The double stranded DNA unwinds and weak hydrogen bonds break
 - Free floating nucleotides from the nucleus/nucleoplasm attach to the complementary bases
 - New hydrogen bonds form by the action of DNA polymerase
 - Two identical chromosomes are formed

Any 4 logical steps

- 3.1.5 (a) Provides instructions/genetic code for the synthesis of a protein required for cell growth
- (b) Beneficial increased bone density in their neck vertebrae making their neck stronger / increased blood pressure so that blood could reach the brain

- 3.1.6 (a) gene editing tool / to edit genes
- (b)
- In the experimental group – when mice were given the steroid to increase their blood pressure (2b) their blood pressure remained the same as before the drug was given (2a)
 - In the experimental group – when mice were given the steroid to increase their blood pressure (2b) their blood pressure remained the same as before the drug was given (2a)
 - In the experimental group – heart had normal fibroblasts in comparison to scar tissue/ damaged fibroblasts in the control group
 - Without the gene, their bone density was low but when gene was inserted, their bone density increased

Any two well-explained answers from figure 3.1.3

(c) the group that lacked the FGFR1 gene

- (d)
- Same number of mice in each group
 - Same species mice
 - Same age mice
 - Same gender mice
 - Same feed given to the mice
 - Same health of mice at the start
 - **Any other suitable answer**
- Mark the first answer only**

(e) **Yes**

- Can help us find treatments for human diseases (accept any suitable named genetic disease)
- Enhances our research possibilities
- Helps us understand the giraffe better
- **Any other suitable answer**

No

- Study done on mice, might not work on humans
- Still in research stages, much more needs to be done
- **Any other suitable answer**

Yes / No – no mark

Accept any ONE of the above, well-explained – mark first answer only

- 3.1.7
- The FGFR1 gene is isolated from the giraffe and cut out using restriction enzyme
 - A bacterial plasmid is isolated from a bacterial cell and cut using restriction enzyme.
 - The FGFR1 gene is inserted into the plasmid using ligase
 - The recombinant plasmid is inserted into a human cell to be integrated into the human's genetic makeup.

Any four logical steps

3.2 3.2.1 Karyotype/micrograph

3.2.2 Skin cell chromosomes appear in pairs/diploid chromosome number

3.2.3 female

3.2.4 46

- 3.2.5 (a) 28 /14 pairs
(b) 2 / 1pair
- 3.2.6 They have different chromosome numbers 14/28 vs 23/46 chromosomes
- 3.2.7 Chromosomes do not separate during anaphase / meiosis and this results in the incorrect number of chromosomes in gametes / extra chromosomes in gametes

QUESTION 4

4.1

	Labelled part	Name of structure	Function of structure
4.1.1	H	Scrotum	Ensures temperature of testes is regulated.
4.1.2	G	Testes	Produces sperm / testosterone
4.1.3	A	Ovary	Release ova during ovulation.
4.1.4	J	Vas deferens	Transports sperm from the testes/epididymis to the urethra

4.2 4.2.1 Passage for urine/semen

4.2.2 (a) Graafian follicle
(b) Corpus luteum4.2.3 (a) Pituitary gland
(b) High levels of oestrogen inhibit the secretion of FSH This prevents a new follicle from developing and no ovulation takes place

4.3 4.3.1 Fallopian tube and uterus

4.3.2 If it is inflamed, the tube becomes too narrow for the egg or sperm to travel through and fuse with each other no fertilisation occurs. Inflammation in the uterus makes it inhospitable/difficult for the foetus to implant.

Any 4 points listed or 2 well explained answers

4.4 Circle A and B

4.5 $(85\% - 33\%) = 52\%$

4.6 She must have a Caesarean section in this way the baby's eyes will not get infected and there will be no risk of blindness as baby does not move through infected birth passage.

4.7 Actual length = 45 mm (**Accept range 43 – 47**)
Method – $45 / 2000X$
Answer = 0.0225 mm (**must have unit**)

- 4.8
- Lack of awareness
 - Lack of contraceptives
 - Poor medical care
 - Embarrassment to seek medical care
 - ***Any other suitable answer***
- Mark the first one only***
- 4.9 Condoms prevent contact with penis/semen/vagina infected with bacteria.
- 4.10
- Stricter laws on prescription of antibiotics
 - More awareness on antibiotic use and STIs
 - More condoms should be readily available
 - ***Any other suitable answer***
- Mark the first one only***
- 4.11 4.11.1 Graph showing the percentage of bacterial resistance to three different types of antibiotics from 2009 to 2016
- All 3 variables present – 2 marks***
1 variable missing – 1 marks
2 variables missing – 2 marks
- 4.11.2 50% (check final printed copy)
- 4.11.3 Cefixime bacteria have the lowest resistance to this antibiotic / this antibiotic is the most effective against bacteria / lowest curve on the graph indicating lowest percentage of bacterial resistance / lowest curve in recent times / decreasing trend shown in percentage bacterial resistance from 2010 to 2015/2016

Total: 200 marks