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CURRO

HERITAGE HOUSE

GRADE 12 -LIFE SCIENCES – PAPER I

PRELIMINARY EXAMINATION 2024

MEMORANDUM

QUESTION ONE

			Mark allocation
1.1.1	F	✓	1
1.1.2	J	✓	1
1.1.3	L	✓	1
1.1.4	A	✓	1
1.1.5	D	✓	1
1.1.6	E	✓	1
1.1.7	C	✓	1
1.1.8	B	✓	1
1.1.9	H	✓	1
1.1.10	I	✓	1
			(10)
1.2.1	C	✓	1
1.2.2	D	✓	1
1.2.3	C	✓	1
1.2.4	C	✓	1
1.2.5	B	✓	1
1.2.6	B	✓	1
1.2.7	A	✓	1
1.2.8	B	✓	1
			(8)

1.3

COLUMN I	COLUMN II	Mark allocation	ANSWER
Guanine	1. a sugar molecule 2. a phosphate molecule	2	D✓✓
Hydrogen bonds	1. links Thymine to Adenine 2. links deoxyribose sugar to phosphate	2	A✓✓
Centromere	1. point at which two homologous chromosomes are joined 2. point at which two identical chromatids are joined	2	B✓✓
James Watson	1. contributed to the discovery of the structure of DNA 2. worked together with Francis Crick	2	C✓✓

(10)

1.4

- 1.4.1 Recessive. Individual 1 and 2 are normal but they have affected daughters(individual 4 + 5) so the mutation must have been carried silently. ✓✓✓ (3)
- 1.4.2 Heterozygous ✓ (1)
- 1.4.3 25% ✓ (1)

1.5

- 1.5.1 Forest community means there are a number of populations/different species/groups of plants and animals/not just 1 species living together; interacting in one area/same place/not in isolation. ✓✓ (2)

- 1.5.2 ✓✓✓✓ (4)

$$\text{Pop} = \frac{\text{Average number per quadrat} \times \text{size of area}}{\text{Size of quadrat}}$$

$$= \frac{(4+4+4+2+1+3) \times 12000 \text{ m}^2}{100 \text{ m}^2} \quad \text{OR} \quad 3 \times 120$$

$$= 360 \quad = 360$$

Answer only (no working) max 1

- 1.5.3
- Quadrats must be randomly placed.
 - Size of whole area must be known.
 - Size of quadrats must be constant.
 - Size of quadrat must be known.
 - Accurate counts within quadrat must be done.
 - Sufficient number of quadrats must be counted.
 - Method should be repeated and averaged for more reliable results.
- (Any 3 points)
- ✓✓✓ (3)

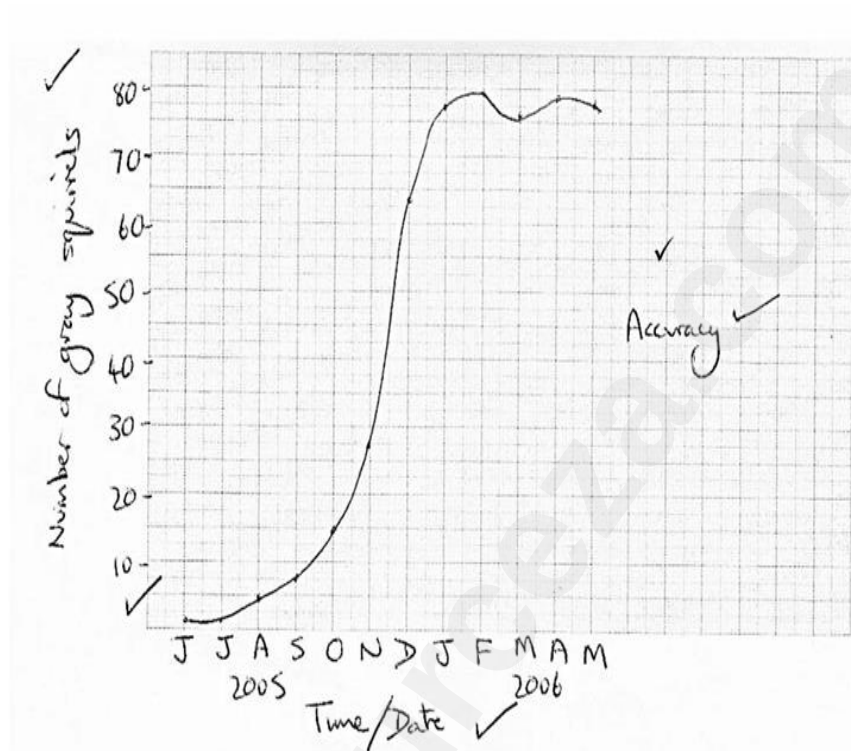
- 1.5.4 Niche partitioning/resource partitioning. Different plant species grow to different heights/strata in response to different light requirements and so they are able to live together ✓✓✓ (3)

- 1.5.5 Secondary succession ✓✓ (2)

1.5.6.

(7)

- (a) Heading: Graph showing population size/number of Grey Squirrels over time.



- | | | | |
|-----|---|-----|-----|
| (b) | Establishing nests/finding mates/adjusting to new area. | ✓✓ | (2) |
| (c) | Abundant resources/well below carrying capacity so no environmental resistance resisting growth. (any reasonable answers) | ✓✓✓ | (3) |
| (d) | The maximum number of individuals of a population that the environment can sustain. | ✓✓ | (2) |
| (e) | 75 – 80 | ✓ | (1) |

1.6

	Statement		A, B or C	
1.6.1	There are 1 215 rhino left in South Africa.	✓✓	C	(2)
1.6.2	The number of poached rhino has shown a sharp upward trend in the past five years.	✓✓	A	(2)
1.6.3	After 2016 we should see living rhino numbers levelling off.	✓✓	B	(2)
1.6.4	Rhino poaching is a crime punishable by law.	✓✓	C	(2)
1.6.5	From 2012 – 2013, the number of rhinos poached increased by 336.	✓✓	A	(2)

(10)

1.7

- 1.7.1.
- a. W – nucleotide
U – DNA ✓✓ (2)
 - b. X - Phosphate
Y - Deoxyribose ✓✓ (2)
 - c. Z- Hydrogen bond ✓ (1)
- 1.7.2
- The two strands would not separate✓ ✓✓✓ (3)
 - The DNA will not replicate✓
 - and proteins synthesis will not take place✓

Total Question 1 [80]

QUESTION TWO

2.1

2.1.1 Chimpanzee (1)

2.1.2 Narrow thin elongated pelvic girdle – does not support upright weight of body above pelvis/narrow pelvis – weight also supported on forehands/ quadrapedal divergent big toe – indicates tree climbing/arboreal ability/opposable big toe – used for grasping branches/climbing trees
Foot bones/ sacrum smaller cannot support body weight
(include other suitable answers). (4)

2.1.3 Hands freed; greater dexterity carry food make and use tools make and control fire therefore greater brain development
Habitat changing to savannah: move across grasslands more efficiently find/see new sources of food therefore greater brain development
Upright posture: could see over grass more easily observe predators/prey more intimidating to predators stay cooler in sun as less of body exposed to direct heat (greater brain development – concept = 1 mark only)
Accept any 4 good facts and different wording meaning same as above (4)

2.2

2.2.1 Grey (1)

2.2.2 Caused by expression of the genotype/gene variation within all populations natural selection of more suited genotype to environment/different alleles for different colours of wings/genotype selected for because of camouflage from predators' mutations causing different alleles / dominant and recessive genes (2)

2.2.3 a) II (1)

- b) Countryside; there are more light moths; as the trees are not covered in soot/trees covered in lichen/fewer dark moths; as predators have eaten the dark ones/more exposed./ Light moths camouflaged escape predation (accept wording that explains why it COULD NOT be industrial area) (3)
- 2.3
- 2.3.1 Different species of (Darwin's) finches have arisen on the Galapagos (specific place names not required) Islands due to population becoming isolated by the sea between islands that each have different environments/feeding niches Or other example; tortoises; iguanas; cichlids, Grand canyon squirrels, etc. (Name clearly place/location description) (3)
- 2.3.2 Due to isolation, gene flow is restricted gene frequencies change there are different selection pressure in each population □ different phenotypes develop/differences become so great that populations become reproductively isolated/new subspecies develop. *Three acceptable points*, where wording is different, but concept same as above underlined (3)
- 2.3.3 It flew to the island; westerly wind assisted flight/westerly wind blew these butterflies to the island (2)
- OR
- sea levels rose/flooding; mainland species evolved into subspecies owing to isolation. eggs/larvae on food in boats (or other reasonable explanation.)
- 2.4 Mutations produce variations antibiotic resistance mutation/gene selected for gives survival advantage to these bacteria pass on resistance gene to offspring persist and reproduce many resistant bacteria therefore antibiotics (4)

not effective for humans (N.B. Relate resistance to 'bad for humans', e.g. antibiotics can no longer cure bacterial infections in humans/humans die include: economic implications of discovering antibiotics and revenue lost to sick days)

Must cover natural selection and antibiotic

resistance = 2 to 3 marks

Problem for humans = 1 mark

- 2.5.1 Reproductively isolated/unable to breed with original northern and southern frogs mating call differences offspring between northern and southern frogs not viable. (2)

(Max two)

- 2.5.2 Variation in male calls/males calls most closely resembling southern calls/calls with faster note rate and longer duration selected by southern females more often males with southern call more likely to reproduce with southern females offspring with southern call more chance of survival gene for call passed to offspring over time southern mating call most numerous in species. (4)

(four good facts sequentially)

- 2.5.3 New individual resulting from mating of two genetically dissimilar frogs (2)

- 2.5.4 Divergent groups of frogs had a common ancestor. (2)

- 2.5.5 **Reliable:** research conducted by experts/scientists in field from a university many scientists agree (2)

Not reliable:

no peer review

no publication of findings mentioned

QUESTION THREE

3.1.1 (a) Mm (1)

(b) $\left(\frac{8}{12} \times \frac{100}{1}\right) = 67\%$ (2)

(c) isolate manx cats during breeding season to ensure that mating occurs only between selected manx cats. Provide good prenatal and birth care to ensure that fertilised ova; develop into kittens/(survival of kittens only dependent on genotype/ not health issues). Count dead kittens also, include in stats to quantify lethal genotype

Any other reasonable answer

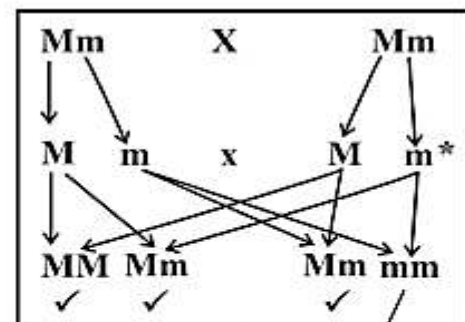
(2 × 2 = 4)

3.1.2 (a)

	M	m
M	MM	Mm
m	Mm	mm

= correct gametes

(b) lethal genotype



* = correct gametes

(b) lethal genotype

(a): (3 + 1 = 4)

If incorrect genotype used in Punnett or Cross, then mark three genotypes as a result of incorrect cross = possible 3 marks; no mark given for incorrect

gametes = 0

(b) mm = genotype that would die before birth (only marked on cross) (1)

3.1.3 Yes – suggests statistical data for inheritance of lethal mutations, etc.

OR

No – inheritance in cats not helpful/different species to humans, etc. (2)

(accept other suitable answers)

3.2

Project: Sequencing of human genome/identifying all genes/determining order of nucleotide bases in (coding) DNA of human chromosomes collaboration of scientists across the world.

Implications: Understand exactly what each gene codes for/increased understanding of disorders/expression of genes finding cures/correcting defective genes. (accept other suitable outcomes)

Include : little impact = too costly little understanding as yet of all genes/DNA

Project + implications OR project + implications (5)

(accept other suitable answers)

3.3

3.3.1 GMO an organism that has had a selected/desired foreign gene/alterd genetic makeup inserted into its genome/chromosomes (or other correct definition) (1)

3.3.2 (a) Access to research facilities /funds to develop GMOs/large nation requiring large amounts/successful crop yield any suitable answer (1)

(b) $100\% - (21\% + 6\% + 4\% + 4\% + 1\% + 1\%) = 63\%$ **or** (2)
 $99\% - (21\% + 6\% + 4\% + 4\% + 1\% + 1\%) = 62\%$

3.3.3

(a) advantages: pest/drought/herbicide resistance; increased nutritional value; increased yield; feed increased population numbers; lower production costs, etc. Any two (or other reasonable advantage).

Disadvantages: may introduce allergenic properties; disrupt food chains; may introduce mutagens to food; etc.

Any two (or other reasonable disadvantage). (4)

- (b) yes/no (relate answer specifically to SA)
e.g. Yes: rapidly growing pop numbers will provide sufficient food
e.g. No: need to test more thoroughly to see if produces diseases, etc. other suitable answers explained, e.g. allergenic; destroying food chains, etc. (3)

3.4

3.4.1 (a) Selective breeding/inbreeding /artificial selection/outbreeding (1)

(b) characteristics/features/outward appearance/phenotype/expression of genes/physical appearance/physical attributes (2)

3.4.2 Resists mastitis (bacterial infection); conceives easily; avoids injury; walks and stands comfortably. Any two valid reasons. (2)

3.4.3 Table of differences between selective breeding and natural selection (5)

Column headings + 2 matching points. *Other suitable answers.*

SELECTIVE BREEDING/ ARTIFICIAL SELECTION	NATURAL SELECTION
1. Characteristics selected by farmers	1. Environmental pressures/changes in environment favour certain characteristics
2. Much quicker process – few years	2. Slower process – 100s to 1 000s of years
3. Farmers maintain desired genotype	3. Survival of fittest causes certain genotype to persist
4. Requires human intervention	4. Occurs naturally
5. Purposeful selection	5. Random selection
6. Predictable/known outcome (not for outbreeding)	6. Outcome unpredictable / unknown
7. Less variation (not for outbreeding)	7. More variation
8. Assistance needed	8. No assistance needed/environment dictates
9. Not necessarily for survival	9. For survival
10. Not necessarily fittest surviving/used for breeding	10. Only fittest survives/breeds

[40]

QUESTION FOUR

4.1

- 4.1.1.
- A DNA test is a medical procedure done to analyse genetic information/chromosome analysis.
(Definition 1 mark)
 - DNA sample amplified using PCR.
 - A DNA sample is subjected to gel electrophoresis (or a description of process).
 - It separates into different bandwidths according to mass. This gives a picture known as a DNA profile/fingerprint.
(Explanation max 3 marks or any other reasonable explanation)

(4)

- 4.1.2 FOR: It was not their fault – their baby belongs to them so should be returned to them. Or anything suitable.

AGAINST: Already bonded with other baby/too traumatic to separate/or anything suitable.

(Explanation max 4 marks or any other reasonable explanation) (4)

- 4.1.3 Child 1 is the biological child as their DNA bands match one of the parents' bands (or Child 2 is not as their DNA bands do not match either of parents' bands). (4)

- 4.1.4 Identifying dead bodies/linking criminals to crime/identifying source of poached plants and animals or anything suitable (not paternity). (4)
(any other reasonable explanation)

4.2

- 4.2.1 X-chromosome (1)

- 4.2.2 Mainly males get the disease as in females, if they have a mutated gene, they may have a healthy gene to mask the recessive mutated gene. It is a rare disorder – if it was a dominant mutation, it would be more prevalent. (4)

- 4.2.3 Colour blindness – inability to distinguish between colours.
OR Haemophilia – inability to clot blood (or any example) (4)

4.3

- 4.3.1 Resistance of bacteria to penicillin/number/amount/proportion of bacteria killed/size of clear zone. (1)

(Answer must refer to death or survival of bacteria.)

- 4.3.2 Type of bacteria (1)

- 4.3.3 Quantity/conc. of bacteria; size of well; quantity/quality of penicillin; size of Petri dish; temp at which Petri dishes were kept; type/brand of nutrient agar; amount of nutrient agar. (Any 3) (3)

- 4.3.4 Bacteria (A/B/C/D/E) has the greatest resistance to penicillin (statement)./ Antibiotic resistance varies between different bacteria./All bacteria are equally resistant to penicillin. (3)

- 4.3.5 C. Because there was no clear zone around it meaning that no bacteria were killed by the antibiotic (3)

4.3.6

- a. To ensure that the penicillin was causing the death of bacteria and not another factor. (2)

For comparison

- b. Penicillin (2)

[40]

TOTAL: 200 MARKS