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PRELIMINARY EXAMINATION PAPER 1

MARKING GUIDELINES

QUESTION 1

1.1. Match the columns

COLUMN A	COLUMN B	COLUMN C
C ✓	1.1.1. Enzyme used to facilitate bonding of free DNA nucleotides	A. Immigration
E ✓	1.1.2. A factor which reduces population size	B. Bivalent
H ✓	1.1.3. The point of crossing over between homologous chromosomes	C. Polymerase
G ✓	1.1.4. A single trait which is controlled by many different genes at different loci	D. Watson & Crick
I ✓	1.1.5. Recorded first images of DNA using X-Ray Crystallography	E. Emigration
		F. Multiple Alleles
		G. Polygenic
		H. Chiasma
		I. Franklin
		J. Helicase

1.2. Multiple Choice

1.2.1.	1.2.2.	1.2.3.	1.2.4.	1.2.5.
C ✓	D ✓	B ✓	A ✓	C ✓

1.3.

- 1.3.1. Protein Synthesis ✓ (1)
- 1.3.2. It produces proteins which are the building blocks of living organisms ✓✓ or similar answer. (2)

1.3.3.

Letter	Label
A	DNA double helix/ Nuclear DNA ✓
B	mRNA ✓
C	Nuclear Envelope/ Nuclear Membrane/ Nuclear Pore ✓
D	Amino Acids ✓
E	tRNA ✓
F	Polypeptide Chain/ Growing Protein Chain ✓
G	Ribosome ✓
H	Cell Membrane/ Plasmalemma ✓

1.4.

1.4.1. A cell division to form four ✓ genetically unique ✓ gametes ✓ (3)

1.4.2. One of the duplicated chromosomes did not split during meiosis 2 ✓ causing one gamete to have an extra chromosome, and one gamete to have a chromosome too little. ✓
(2)

1.4.3. 50% ✓ (1)

1.4.4. **Gamete a:** 23 ✓

Gamete c: 24 ✓

Gamete d: 22 ✓
(3)

1.4.5. When a female is of older reproductive age ✓ and this affects the way that chromosomes separate during meiosis/ can cause chromosome non-disjunction/chromosomes can become sticky ✓ etc. (2)

1.4.6. a. A normal male zygote ✓✓ will form (2)

b. Male with Klinefelter Syndrome will form ✓✓ (2)

c. A female with Turner Syndrome will form ✓✓ (2)

1.5.

1.5.1. DNA Fingerprinting/ Gel Electrophoresis ✓ (1)

1.5.2. PCR/ Polymerase Chain Reaction ✓ (1)

1.5.3. To make sure that the DNA that was found on the crime scene belonged to the killer and not the Victim (as the victim was present at the crime scene as well). ✓✓ (2)

1.5.4. Suspect 1 ✓ (1)

1.5.5. No ✓ it merely places the suspect on the crime scene/ the DNA could have been left there another time/ someone could be framing the suspect/ more than just DNA evidence is needed to convict the suspect ✓ (2)

1.6.

1.6.1. A new organism that is genetically identical to another pre-existing organism ✓✓ or similar (2)

1.6.2. None ✓. The entire nucleus & all the DNA comes from the woolly mammoth/ the parent elephant is only used as a surrogate ✓ (2)

1.6.3. Any two appropriate

Eg: the ecological niche of mammoths could no longer exist/ where would the mammoth live?/ would the social structures & instincts of mammoths suit a lone mammoth's lifestyle? (2)

1.6.4. Any appropriate

Eg. It could provide insight into the evolution of the mammoth/the origins of the mammoth/ the extinction of the mammoth etc. (1)

1.7.

1.7.1. A- worker ✓ B- Drone ✓ C- Queen ✓ (3)

1.7.2. Eusocial/ Socially Organised ✓ (1)

1.7.3. They only have DNA from the queen bee ✓ and not from another source ✓ (2)

1.7.4. A cell with One set of chromosomes ✓ (1)

1.7.5. ✓ for line correctly drawn across length of the Queen Bee (Bee C)

Actual Size = measured length of line/2,5 ✓

Actual Size = Answer ✓ unit ✓ *check length of line drawn by individual*

Length of BEE → Approximately 51mm

Answer should be between 19,6mm and 20,8mm (4)

1.8.

1.8.1. To allow it to hover in mid air for feeding ✓ *or similar* (1)

1.8.2. *candidates must choose ONE of the features from the list. If they do not choose one, they will not have ANY marks awarded. Only ONE feature is needed; and must be written about in the two different ways (Lamarck/Darwin)*

Darwin:

Beaks: Original population of hummingbirds had beaks that were different lengths and thicknesses ✓. Longer and thinner beaks allowed some birds to eat more efficiently ✓ and therefore they survived and produced offspring with long and thin beaks ✓

Wings: Original population of hummingbirds had wings that were various shapes and sizes ✓. The narrow and tapered wings allowed the birds to fly better ✓ which allowed them to survive better. The survivors then lived to reproduce and pass on the narrow and tapered wing trait ✓

Tail Feathers: Original population of hummingbirds had tails that were made up of different numbers of feathers ✓. The birds with fewer tail feathers were lighter and able to fly more easily ✓. This made them survive better and pass on the fewer tail feather trait to their offspring ✓

Max 3 marks for ONE complete correct description

Lamarck:

Beaks: Original hummingbirds had shorter & thicker beaks ✓. The more they were used the longer and thinner they became ✓. These acquired characteristics were passed on to their offspring ✓

Wings: Original hummingbirds had shorter and thicker (untampered) wings ✓. The more they flew, the more tapered and longer/narrow wings became ✓. These acquired characteristics were passed on to their offspring ✓

Tail Feathers: Original hummingbirds had more tail feathers ✓. The less they used their tails/tail feathers, the smaller/less tail feathered the tails became ✓. This acquired characteristics were passed on to their offspring ✓

Max 3 marks for ONE complete correct description

(6)

1.9.

1.9.1. Yes it is credible ✓ it is sourced from the United Nations Department of Social and Economic Affairs ✓ (2)

1.9.2. *Any three appropriate and/or correct.*

Examples:

- Medical care has improved
- Care of premature/ill infants has improved
- Farming has improved in efficiency (both crop and livestock) (3)

1.9.3. *Any TWO correct and appropriate*

Examples:

- It helps with planning of government services
- Helps with planning of towns
- Helps with budgets/ tax money etc. (2)

1.9.4. *Any TWO correct and appropriate*

Examples:

- People may lie on the census
- Illegal immigrants not counted
- People may not complete the forms/ may not be home when census is carried out (2)

19.5. *Any ONE correct and appropriate*

Examples:

- Earth may run out of space
- Coronavirus may cause decline in the population

- As education increases, then people may choose to have less children or have children later in life (1)

QUESTION 2

2.1.

2.1.1. Karyotype ✓ (1)

2.1.2. Female ✓. Two X chromosomes present ✓ (2)

2.1.3. One of the chromosomes in pair 5 is noticeably smaller than the other ✓ which would mean that part of the chromosome has been deleted/ those genes are missing ✓ (2)

2.1.4. The mutation would remove nucleotides/ nitrogenous bases/ part of the genetic sequence ✓ which would change the genetic instruction/ protein product ✓ (2)

2.1.5. Genotype: **the genetic instruction/ base sequence of a gene/ allele combination** ✓ in example above- the missing nucleotides that would cause cri-du-chat versus the full base sequence that would lead to a 'normal' individual

Phenotype: **the physical manifestation of the genetic instruction- protein produced/ physical characteristic caused by the genes** ✓ in example above- having cri-du-chat or not having it

✓ for one reference to the cri-du-chat example (3)

2.1.6. Yes/No ✓ appropriate substantiation with at least TWO points made ✓✓

Eg. Yes ✓ it will help parents to find out the odds of this occurring again ✓ and will also provide support in their decisions ✓

Yes ✓ it will help parents make a decision before they are pregnant ✓ and have to make quicker decisions ✓

No ✓ there is probably not a 100% chance that the next child will be affected ✓ and some people are against abortion anyway ✓ (3)

2.2.

2.2.1. It is passed on mostly unchanged from mother to child ✓. It does not undergo crossing over, so is easier to track ✓. It has a known mutation rate ✓

Any TWO (2)

2.2.2. Mitochondrial DNA: composed of 100% maternal mtDNA ✓

Nuclear DNA: 50% maternal and 50% paternal ✓ (2)

2.2.3. Yes/ No ✓ appropriate substantiation with at least TWO points made ✓✓

Eg. Yes ✓ Mandela was a world beacon of leadership ✓ and would be an example to many that may reduce racism/xenophobia ✓

Yes ✓ Mandela most likely signed permission for these results to be published ✓ and it was of wide public interest to the South African public ✓

No ✓. Everyone has a right to privacy ✓ and DNA data is not an exception to this ✓
(3)

2.3.

2.3.1. Dominant: widow's peak ✓ Recessive: straight hairline ✓ (2)

2.3.2. Males and females have both types of hairlines in similar ratios ✓✓ (2)

2.3.3. a. hh ✓ b. Hh ✓ c. hh ✓ (3)

2.3.4.

Parental genotypes: Father- hh Mother- hh ✓✓ for both parental genotypes

Punnett Square:

	h	h
h	hh	hh
h	hh	hh

✓✓ for correct punnett square

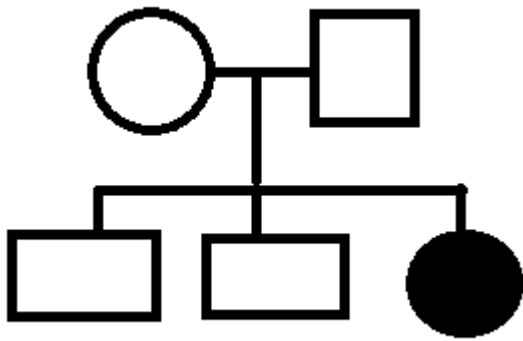
F1 Genotypes: 100% hh ✓

F1 Phenotypes: 100% straight hairline ✓

If 2.3.1. answer was incorrect- carry over error will be allowed in this question

(6)

2.3.5.



✓ for both parents correct

✓ for two sons correct

✓ for daughter correct

(3)

2.4.

2.4.1. $F^G F^G$ ✓

$F^G f$ ✓

(2)

2.4.2. Red feathers ✓✓

(2)

QUESTION 3

3.1.

3.1.1. Sympatric speciation ✓

When a new species evolves from a previously existing species ✓ in the same geographical area as the ancestral species ✓

(3)

3.1.2. The two eating groups are still able to breed ✓✓

(2)

3.1.3. *Orcinus* ✓

(1)

3.1.4. When a group of organisms diversifies to fill different ecological niches ✓. The original whale group diversified to form different eating groups in order to prevent competition for food ✓ or similar. **DO NOT AWARD FULL MARKS UNLESS THE WHALES HAVE BEEN REFERRED TO.**

(2)

3.1.5. Any appropriate eg. Cichlid fish of Lake Malawi ✓

(1)

3.2.

3.2.1. A group consisting of humans and pre-historic humans ✓ and their ancestors ✓
as well as some of the apes ✓ *or similar* (3)

3.2.2. G ✓- all toes are parallel/ big toe is parallel to the other toes/ large heelbone/
no opposable big toe ✓ *only ONE explanation needed* (2)

3.2.3. C ✓ E ✓ G ✓ (3)

3.2.4. B ✓ out of the three, *sediba* is the most primitive/ square jaw is most primitive/
larger canines are most primitive ✓ *only ONE explanation needed* (2)

3.2.5. F ✓. It is shorter and wider than the ape pelvis/ short and wide because *Homo habilis*
were bipedal ✓ *only ONE explanation needed* (2)

3.2.6. Yes this is true ✓

- it allowed early hominids to change habitat ✓
- it allowed hominids to gather food more efficiently ✓
- prevented hominids from being over exposed to harmful sun rays ✓

- Allowed hominids to have further vision- to find food or see predators
- Allowed hominids to carry & protect young
- Allowed hominids to make & use tools for fire and defence

ANY THREE of the above (4)

3.3.

3.3.1. *A. sediba*/ *A. africanus*/ *A. afarensis* ✓ only ONE needed (1)

3.3.2. “.. placed all deceased members in one place in some sort of ritual” ✓ (1)

3.3.3. Table to show the primitive and modern features of *Homo naledi* ✓

Modern	Primitive
Human-like skull shape	Primitive shoulders
Versatile hands suggesting tool use	Flared pelvis
Long legs	Curved Fingers
Human-like feet	

✓ per full correct line across table (one correct primitive and one correct modern feature)

SUBTRACT ONE MARK IF NOT IN TABLE FORM (4)

3.3.4. It prevents false news being published/ it furthers scientific testing/ it allows scientists to collaborate/ it allows scientists to pool their knowledge and understanding etc. ✓✓✓ any THREE (3)

3.3.5. AS= measured length x actual length of scale/ measured length of scale ✓

AS= 25 x 10/ 15 ✓

AS = 16,67 ✓ meters ✓

Accept range: 13,53m → 20,77m (4)

3.3.6. Apes are more similar to very primitive/early hominids ✓ because they have not changed much over time as their environment has not changed ✓ (2)

QUESTION 4

4.1.

4.1.1. Yes ✓. Date is from the World Economic Forum which is a respected organisation ✓ (2)

4.1.2. Centre for Disease Control ✓ or similar (*D must stand for disease*) (1)

4.1.3. Day 20 the infection rate was very low but on day 35 it was exponentially more ✓✓ (2)

4.1.4. As more people contracted the virus, each of them infected more people, causing a very rapid increase in cases ✓✓ (2)

4.1.5. Density dependent ✓. The disease is more likely to spread in populations where many people are in close proximity to each other ✓ (2)

4.1.6. – Economic effects

- effects on hospital infrastructure

- effects on schooling/ education

- effects on travel

Any TWO correct and appropriate ✓✓ (2)

4.2.

4.2.1. The maximum number of ladybirds never exceeds maximum numbers of aphids/ ladybird numbers only increase after aphid numbers increase ✓ etc. *only ONE needed* (1)

4.2.2. The ladybird numbers were increasing ✓ which means that there were more ladybirds preying on aphids, so aphid numbers decreased quickly ✓ (2)

4.2.3. The ladybird population depends on the aphid population ✓. If there are less aphids, there will be less ladybirds ✓ *or similar* (2)

4.2.4. There were less aphids due to ladybirds feeding on them ✓. Then ladybird numbers decreased due to lack of food ✓ (2)

4.2.5. a. Number of weeks ✓

b. Average number of aphids/ladybirds per rosebush ✓ (2)

4.2.6. a. $P = M \times S / T$ ✓

$$P = 30 \times 50 / 12 \checkmark = 125 \checkmark \quad (3)$$

b. mark should not harm organism/ enough time between captures to allow redistribution into population/ not too much time between captures so no births or deaths occur in the time/ closed population ✓✓ *for any TWO* (2)

4.2.7. aphids are too fast moving and will not stay in a quadrat ✓ (1)

4.3.

4.3.1. Density independent ✓. A fire will occur regardless of population size of all organisms ✓ (2)

4.3.2. Secondary ✓ succession ✓ (2)

4.3.3. a. Pioneer community ✓

b. Climax Community ✓ (2)

4.3.4. 2077 ✓✓ (2)

4.3.5. – they provide fuel for wildfires (text) ✓

- they take up space of indigenous vegetation/ they use up water supplies (own)
only one needed ✓ (2)

4.4.

4.4.1. all adults are involved in looking after pups/ only two alphas with best genetics breed/ food is brought and shared equally with old and pups/ they hunt in packs with strategy ✓✓ *for any TWO* (2)

4.4.2. They have increased steadily ✓ from about 5 packs to about 30 packs ✓ (2)

4.4.3. Yearlings are not bound to the den, so are easier to count/ yearlings are older and stronger than pups- some pups may die or be killed which would skew data if counted ✓ *ANY ONE appropriate and correct* (1)