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SAHETI PRELIM P1 MARKING GUIDELINES 2023

QUESTION 1

1.1 K D I A G J B F E C (10)

1.2 1.2.1 D✓

1.2.2 A✓

1.2.3 C✓✓

1.2.4 A✓✓

1.2.5 B✓✓ (8)

1.3 1.3.1 (a) Two sets of complete chromosomes present in a cell✓ (1)

(b) Ovary✓ (1)

1.3.2 (a) Anaphase I✓ (1)

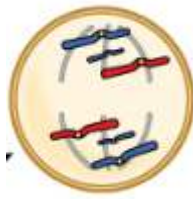
(b) Homologous chromosomes separate✓ and are pulled apart by spindle fibres✓ to opposite poles of the cell✓

(Any 2) (2)

(c) Non-disjunction✓ has occurred. The homologous chromosomes have failed to separate✓ and one set has gone to one pole✓ while the other set has not moved to the other pole at all✓

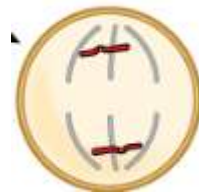
(Any 2) (2)

1.3.3 Cell B – 6 chromatids✓ 3 different chromatids at each pole✓



Accept if students draw chromosomes with 2 chromatids each and show 3 chromosomes

Cell C – 2 chromatids✓



Accept if students draw chromosomes with 2 chromatids each and show 1 chromosome

Cell D – 3 chromatids✓



Cell E – 1 chromatid✓



(5)

1.3.4 Fertilisation of a normal sperm (one gonosome/X chromosome)✓ with an egg containing two X chromosomes✓ (2)

1.4

1.4.1	1.4.2	1.4.3	1.4.4	1.4.5	1.4.6
B	B	A	B	C	A

(6)

1.5 1.5.1 (a) Pituitary gland✓/Hypophysis✓ (1)

(b) The adenoma cells have more growth hormone✓ (more growth hormone has been produced)/more dark grey areas✓ than the normal somatotrophic cells which have less growth hormone✓/less dark grey areas✓ (2)

- (c) It is necessary to use as a comparison/control✓ to show how healthy cells appear✓ (2)
- (d) Any **TWO** of the following symptoms:
 Enlarged hands and feet/ abnormally large tongue/ Enlarged facial features, including the facial bones, lips, nose, and tongue/ Coarse, oily, thickened skin/ Excessive sweating and body odour/ Fatigue and joint or muscle weakness/bulging chest, deepening of voice, enlarged organs, erectile dysfunction, fatigue, infrequent menstruation, large ears, large feet, large hands, large nose, protruding jaw, snoring, or vision disorder✓ (2)
- 1.5.2 pituitary dwarfism ✓ – height is reduced, body proportions normal, not mentally retarded, often sexually immature ✓ any x1 description (2)
- 1.5.3 $191 \times 3 = 573$ ✓ (2)
- 1.6 1.6.1 plasmid ✓ (1)
- 1.6.2 D/E ✓ (1)
- 1.6.3 Restriction enzyme✓ (1)
- 1.6.4 Growth hormone gene isolated/extracted✓ Plasmid removed from bacteria✓ Bacterial gene removed from plasmid✓ Growth hormone gene inserted into bacteria✓ Bacteria grown in culture produce growth hormone✓ Growth hormone extracted and bottled✓
(Any 4 points) (4)
- 1.6.5 The human genome project identified the exact position/locus✓ and exact sequence✓ of the human growth hormone gene so that the gene could be removed from that particular chromosome and inserted into a plasmid✓
(Any 2 points) (2)
- 1.6.6 People may overuse growth hormone✓ which is a form of doping✓. Growth hormone increases growth of muscles✓/increases vitality/energy in older people but also in any other people✓/ Too much growth hormone is dangerous to a person's health✓ Can cause side-effects if not used correctly✓ Hormone imbalances may occur✓
 (One reason, explained or list two reasons) (2)

1.7

Name of structure	Function of the structure	Letter
Testis	Produces sperm cells ✓ and testosterone ✓ (Any one)	H ✓
Sperm duct ✓ / Vas deferens ✓	Transports sperm but not urine.	C ✓
Prostate ✓ gland	Produces milky white alkaline fluid ✓ fluid that neutralises acidity of urine or vagina ✓ Fluid aids in transport of sperm ✓ Fluid contains enzymes that make sperm more active ✓ (Any 1 function)	B
Epididymis ✓	Sperm mature and are stored.	F ✓

(8)

1.8 1.8.1 Internal fertilisation ✓ increases the chances of sperm successfully fertilising the eggs ✓

Courtship - pheromones ✓ OR courtship - dance ✓ ensures that both male and female are ready to mate ✓ allows the female the opportunity to choose the best possible mate ✓ Ensures that the same species of insect are mating ✓

Ovipary ✓ – eggs are laid and covered by a protective substance ✓ and camouflaged from predators ✓ to ensure that as many eggs as possible will hatch ✓

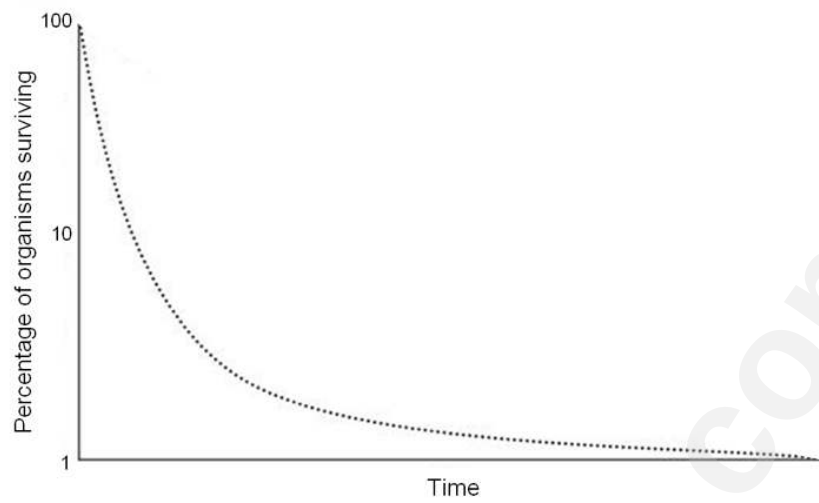
(Any 2 reproductive strategies with explanation) (4)

1.8.2 When the female eats the male, his DNA is incorporated into her eggs – creating more genetic variation in the offspring ✓ Genetic variation allows an organism to be more likely to adapt to environmental changes ✓

More nutrients for the female ✓ ensure that she will have more energy to survive ✓ / produce more eggs / better quality eggs ✓

(Any 2 reasons, well explained) (4)

1.8.3 Graph of survivorship curve of the praying mantis✓



Axes correctly labelled✓✓

Curve✓

(4)

[80]

QUESTION 2

2.1.1 uterus ✓ (1)

2.1.2 ANY TWO

- Provide oxygen and nutrients to the developing foetus ✓
- Remove waste and carbon-dioxide from the foetal circulation ✓
- Provide maternal antibodies to help with temporary passive immunity ✓
- Acts as a barrier preventing many pathogenic microorganisms & drugs from entering the foetus from the mother
- Has an endocrine function (oestrogen/progesterone/relaxin) (2)

2.1.3 C, B, A, D ✓✓

- 1 mark if one is incorrect
- No marks if more than 2 are incorrect (2)

2.1.4 a) 23 chromosomes ✓ (1)

b) The egg is empty so an embryo can't grow ✓. There is no point of keeping an egg that cannot grow and so the body miscarries the empty egg ✓ (2)

2.1.5 If the cells are cancerous then they can spread to other organs of the body ✓
outcompeting the original cells for nutrients etc ✓

ANY REASONABLE ANSWER (2)

2.1.6 a) July ✓ 2005 ✓ (2)

b) 0 - 1 HCG (s) ✓ (accept answers in between) (1)

c) No ✓ her levels of HCG decreased rapidly (to zero) within 8 weeks ✓ (2)

2.1.7 Patient may have had a molar pregnancy and dr wants to see if there is a risk of cancer if HCG levels have not decreased, dr would not want to stress the patient about a potential cancer diagnosis unnecessarily ✓

ANY REASONABLE ANSWER (2)

2.1.8 Yes/ No (no mark)

No

- The patient has a right to know that they may have cancer ✓
- They may want the time to prepare in case they do have cancer ✓
- They may need time to grapple with the concept of perhaps having cancer ✓

Yes

- There is no point in causing unnecessary stress and anxiety around a cancer diagnosis if it takes 2 months to determine ✓
- Most of the time the cancer is benign so there is nothing to worry about anyway ✓
- Most of the time, the whole molar pregnancy is removed anyway ✓

ANY THREE REASONABLE POINTS (3)

2.2.1 a) progesterone ✓

b) oestrogen ✓

c) oestrogen ✓ (3)

2.2.2 An increase in libido would increase the chances of copulation at this time ✓
meaning there is a greater chance of fertilizing an egg which is released at
day 14 ✓ (2)

2.2.3

- As the Graafian follicle matures ✓, it causes the ovaries to produce oestrogen ✓
- This increase in oestrogen causes the pituitary gland to release LH ✓
- Which leads to ovulation – release of an ovum from the Graafian follicle ✓ (4)

2.3.1 YES/NO (no mark)

Yes

- It will help with the severity of cramps which may improve her overall state. ✓
- It will help with acne, which may make her feel more confident. ✓
- There is a benefit of taking it now and reducing the risk of certain cancers ✓
- May also protect her against osteoporosis which she could get during menopause ✓

No

- It could lead to depression which is worse than heavy periods ✓
- It could lead to clots which could kill her in the long run ✓
- It could cause terrible side effects which are worse than heavy periods ✓
- It could cause bleeding between periods which is uncomfortable ✓
- ANY THREE REASONABLE POINTS (**must be explained, can't just be listed**) (3)

2.3.2

- Injectables / Depo-Provera ✓
 - lasts 3 months so you can't forget to take it everyday – more reliable ✓
 - Male / female condom ✓
 - Not only does it prevent pregnancy but also STIs ✓
 - Easy to use ✓
 - Not invasive
 - Intra uterine devices ✓
 - Reliable method of contraception ✓
 - Don't have to remember to take a pill everyday ✓
- ANY METHOD AND ONE REASON WHY (2)

2.4.1

- Self-pollination – the pollen from this same plant lands on the stigma of this plant ✓
- Cross pollination – the pollen from a different plant, lands on the stigma of this plant ✓ (2)

2.4.2 Sexual reproduction ✓ it uses gametes for reproduction ✓ (2)

2.4.3 This improves food security ✓ in case there are disasters which lead to the extinction of maize crops, at least the varieties in the seed bank will be saved and can be used to make more maize crops to feed humanity ✓ (2)

QUESTION 3

3.1.1 a) mutation ✓
b) nucleotides ✓ (2)

3.1.2 a) mutation appears on chromosome 16 ✓
b) to develop MDDS, two copies of the faulty gene must be inherited ✓ (2)

3.1.3 Mitochondria provide cells with energy ✓ Muscles require lots of energy ✓ to function efficiently; fewer mitochondria results in a lack of energy in the muscles ✓ resulting in muscle weakness . (3)

3.1.4 a) False ✓ nDNA ✓
b) False ✓ 792 ✓
c) True ✓ /False – gene mutations (can say false here as point mutation is a change in a **single base pair of DNA** by substitution, deletion, or insertion of a **single nitrogenous base** – text speaks of “genetic errors”)
d) True ✓ (6)

3.1.5

- The mRNA containing the code for **thymidine kinase 2** ✓ arrives at the ribosome
- tRNAs bring specific amino acids ✓ to the mRNA at the ribosome
- Anticodon and codon are complementary ✓ to each other.
- Once amino acids are placed close together, peptide bonds ✓ form in between them.

- Once the stop code ✓ is reached, the **thymidine kinase 2 enzyme has been made.**

Any 4 logical steps and must be in context of TK2 enzyme, otherwise lose one mark (4)

3.1.6 The mutation/genetic error within the TK2 gene alters the sequence of the amino acids ✓ that make up the thymidine kinase enzyme, therefore the structure of the enzyme will be altered ✓ and the mtDNA nucleotides /building blocks cannot be synthesised ✓ so more mtDNA cannot be produced/cannot be replicated resulting in reduction ✓ in the number of mitochondria. (4)

3.1.7 a) Dd ✓
dd ✓ (2)

) **P1**
Phenotype: Unaffected / Carrier for MDDS X affected MDDS ✓
Genotype: Dd ✓ X dd ✓ (can mark on punnett square)

	D	d
d	Dd	dd
d	Dd	dd

✓ all correct on punnet square

F1: Genotype: 50% Dd and 50% dd

Phenotype: 50% unaffected MDDS and 50% affected MDDS

Therefore, 50% ✓ probability of having another child with MDDS (5)

c)

Option	Punnett square ✓	Text ✓	Own knowledge ✓
Yes	Only 50% probability of having a child with MDDS – not definite.	- Only affects 1 in 5 000 children - Symptoms can be treated. - Future looks bright – CRISPR and gene therapy.	- With the advancement in technology, there will be many options to treat disorders. - CRISPR and gene therapy have shown much success, so possibility to work in this case as well. Any other suitable answer.

No	50% probability of having a child with MDDS – this is a great risk.	• Most severe / fatal in first two years of life. • Respiratory failure. • No cure. • Only symptoms can be treated. • Future treatments are still in clinical trials – may not work.	• Death is traumatic for parents / siblings. • Costly to treat symptoms. • Parents not capable to manage the disorder, might need a nurse. • Any other suitable answer.
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(3)

d) A test that studies / examines / analyses a person's DNA✓ to identify mutations / changes in genes / genetic disorders✓ (2)

e) No, since it is a point/gene mutation ✓ it is too small to be seen on a karyotype ✓/only chromosomal mutations can be seen on a karyotype. (2)

3.1.8 a) CRISPR ✓

(1)

b) Cas 9 ✓

(1)

c)

CRISPR	Gene Therapy
Repairs defective genes on nDNA.	Repairs defective genes on mtDNA.
Vectors are not used.	Vectors are used.

Any one correct difference showing comparison for two marks (2)

d) To ensure that it is safe to be used on humans ✓ (1)

[40]

QUESTION 4

4.1.1 Ample food supply from scraps of food found in residential areas ✓

Ample nesting sites in gardens / other parts of the home (under ledges etc) ✓

Less competition with other bird species in natural areas ✓

Accept other suitable answers

max 1 (1)

4.1.2 they have aggressive competition with other birds for nesting sites / feed on eggs of other birds / take nesting material from other birds / take over other birds nests / this will decrease biodiversity in the KNP

Accept any 2 (2)

4.1.3 Remove nests as soon as they appear ✓, this will prevent numbers from increasing any further as the myna appears to be in the initial phase of setting up ✓ (2)

4.1.4 (a) Mark-recapture method /Petersen index ✓ (1)

(b) $P = \frac{M \times C}{R}$ ✓
 $= 300 \times 230 / 50$ ✓
 $= 1380$ ✓ (4)

4.1.5 (a) interspecific competition ✓ (1)

(b) Resource partitioning ✓ – they could use the same resources slightly differently from the other birds ✓, like eating different parts of the same plant ✓ or feeding at different times ✓ or feeding in different parts of the same habitat ✓

1 mark for mentioning resource partitioning & 3 marks for explanation (4)

(c)

2 graphs ✓

Graphs level off ✓

Axes labelled ✓

Key or graphs labelled ✓

(4)

- 4.1.6 (a) The numbers of myna increases in **summer** in the Kruger National Park.

OR The numbers of myna remains the same in both summer and winter in the Kruger National Park.

Ind & Dep variables mentioned ✓

Statement ✓

(2)

- (b) Summer or winter ✓✓/different seasons

(2)

- 4.2.1 With many eyes & ears, the group as a whole is more watchful ✓

A large flock can mob a predator ✓

Dilution effect – the greater the number of individuals in a group, the greater the survival chances are of the individual ✓

Confusion & distraction effect – as a predator tries to single out its prey, the flock scatters in all directions, confusing the predator ✓

The members of a flock protect those who are vulnerable (sick/weak/aged) against predators ✓

During migration, the inexperienced are given guidance & protection by the flock ✓

Accept any 4 suitable answers

(4)

- 4.2.2 Population size is regulated ✓ - competition for resources is avoided ✓

Only strongest genes passed on ✓ – greater chance of survival for offspring ✓

Accept other suitable answers - one well explained or any 2 points **max 2** (2)

- 4.2.3 Co-operative behaviour allows nest building to be shared ✓ / more eyes & ears to defend territory ✓ / more individuals to help feed the chicks ✓ **any 2** (2)

- 4.2.4 Amount of food / Predators / Disease / Living space **any 3** (3)

- 4.3.1 The percent maximum cover of the water hyacinth decreased ✓ as the number of *Megamelus scutellaris* increased ✓ (2)

- 4.3.2 The insects are the natural enemy of the plants ✓, very often invasive species are introduced without the natural enemy and grow out of control ✓ (2)

- 4.3.3 Impose harsh fines for planting invasive species

Mass removal of invasive species from gardens /parks etc

Greater education & public awareness of invasive sp.

Accept any 2 suitable answers (2)

[40]