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SECTION B / SHORT-ANSWER QUESTIONS**INSTRUCTIONS FOR SECTION B**

Answer this section in pen.

Answer all questions in the spaces provided.

Question 1

In the honey bee *Apis mellifera* colony, the adult queen bee is the reproductive female. Honey bees are classified in the order Hymenoptera and demonstrate haplodiploidy, where males develop from unfertilised eggs and so are haploid drones, and females are diploid individuals.

If a queen bee mates only once with a drone, her daughters will be highly related to one another and are known as supersisters.

1a. Why would the daughters be so closely related?

1 MARK

Female bees have 16 chromosomes in their germ cells.

1b. How many chromosomes would be present in the somatic cells of drones?

1 MARK

It was previously thought that sex determination in a colony was controlled by the queen and that on return from a mating flight she could 'choose' whether to lay fertilised or unfertilised eggs which would develop into females or males, respectively. It is now known that sex determination in bees is controlled by alleles at a single locus. If a bee has two different alleles it will be female, if it has a single allele it will be a normal fertile male, if it has two identical alleles it will be an infertile male.

1c. i. What is a locus?

1 MARK

1c. ii. What is the term used to describe the genotype of a normal fertile male honey bee?

1 MARK

1c. iii. Is a colony of honey bees monomorphic or polymorphic for sex determination?

1 MARK

TOTAL 5 MARKS

PRACTICE EXAM 1 / SECTION A MULTIPLE-CHOICE QUESTIONS

Question 1: C

- A is incorrect – the lethal genotype **RR** means that there are only 3 possible viable outcomes.
- B is incorrect – the lethal genotype **RR** means that there are only 3 possible viable outcomes.
- D is incorrect – there is a 66% chance of producing a chestnut roan foal.

Question 2: B

- A is incorrect because mutations do occur in a population; however, mutation does not account for the frequency at which HD is currently maintained.
- C is incorrect because the allele for HD could never be passed on undetected as it is a dominant allele.
- D is incorrect because if a lethal allele is expressed during embryonic development, the embryo/foetus will die – there are no adaptations that allow a foetus to survive a lethal allele.

Question 3: D

- A is incorrect because administration of medication does not impact on the frequency of the lethal allele.
- B is incorrect because onset of the condition is not influenced by diet.
- C is incorrect because physical therapy improves physical fitness but does not change the frequency of the lethal allele.

Question 4: B

- **B is correct** because there are actually two molecules of DNA (each chromatid = 1 molecule of DNA).
- A, C and D are incorrect.

Question 5: A

- **A is correct** because non-disjunction at anaphase I in the father produces sperm which contains either 22XY or 22--. All the mother's eggs would contain 22X. It is impossible to produce a daughter with the karyotype 22XXX, since the maximum number of X chromosomes in the daughter cell would be two.
- B is incorrect because it is possible to produce a female (daughter) karyotype 22XXX if non-disjunction occurs in anaphase II in the father, when an XX from disjunction in sperm fuses with a normal egg containing one X chromosome.
- C is incorrect because it is possible to produce a female (daughter) karyotype 22XXX if non-disjunction occurs in anaphase I in the mother, when an XX from disjunction in egg fuses with a normal sperm containing one X chromosome.

- D is incorrect because it is possible to produce a female (daughter) karyotype 22XXX if non-disjunction occurs in anaphase II in the mother, when an XX from disjunction in egg fuses with a normal sperm containing one X chromosome.

Question 6: D

- A is incorrect because homologous pairs of chromosomes are drawn apart during anaphase I.
- B is incorrect because homologous pairs of chromosomes are assembled together during metaphase I.
- C is incorrect because sister chromatids separate and are drawn apart during anaphase II.

Question 7: C

- A is incorrect because the gene is not heat sensitive, the enzyme produced by the gene is heat sensitive.
- B is incorrect because tyrosinase is not a pigment, it is an enzyme.
- D is incorrect because the interaction between genotype and diet has no outcome on pattern of pigmentation.

Question 8: D

- A is incorrect – a test cross should involve a parent who is homozygous recessive, this parent is heterozygous for both genes.
- B is incorrect – whilst this parent is homozygous recessive for the body colour gene, it is heterozygous for wing type and therefore not appropriate for a test cross.
- C is incorrect – whilst this parent is homozygous for both wing type and body colour, it is not recessive for both traits, therefore it is not appropriate for a test cross.

Question 9: A

- B is incorrect because there would be around 90 straight winged, grey fruit flies produced in this cross.
- C is incorrect because there would be around 30 straight winged, ebony fruit flies produced in this cross.
- D is incorrect because there would be around 30 curly winged, grey fruit flies produced in this cross.

Question 10: C

- A is incorrect because incomplete dominance produces an effect which is intermediate between two different phenotypes, e.g. white x red snapdragons ® pink snapdragons.
- B is incorrect because partial dominance is another name for incomplete dominance.
- D is incorrect because co-dominance produces an effect which is independently and equally expressed between two different phenotypes, e.g. red coat x white coat in horses → roan horses (coat with a mix of red hairs and white hairs).