

SENIOR FIVE ONLINE REVISION QUESTIONS (GENETICS)

- In an oil seed plant species, the allele for tallness is dominant over the allele for dwarfness. Meanwhile, the allele for chlorophyll production and non chlorophyll show incomplete dominance. The heterozygous plants are variegated.

 - Using suitable symbols, construct a diagram of a cross between a tall plant with green leaves and a dwarf plant with variegated leaves to show the genotypes and phenotypes of the offsprings (8 marks)
 - Explain why 25% of the offspring of the cross in (a) would fail to survive. (2 marks).
- In drosophila, the genes for broad abdomen and long wing are dominant over the genes for narrow abdomen and vestigial wing. Pure breeding strains of the double dominant variety were crossed with a double recessive variety and a test cross was carried out on the F₁ generation.

 - Using suitable symbols, work out the expected phenotypic ratio of a test cross of the F₁ generation, if the genes for abdomen width and length of wing are linked. (7 marks)
 - It was however observed that when the test cross of the F₁ generation was carried out, the following results were obtained.

Broad abdomen, long wing	380
Narrow abdomen, vestigial wing	396
Broad abdomen, vestigial wing	14
Narrow abdomen, long wing	10

Calculate the distance in units, between the genes for abdomen width and length of wing. (3 marks)

- State four situations where Mendel's laws would not apply (4 marks)
 - In an animal species, individuals that are homozygous for gene A or its alleles die. Another independent gene B in the homozygous state, blocks this lethal effect, otherwise gene B has no effect on the organism
 - Workout the expected phenotypic ratio of the viable offsprings in a cross of individuals AaBb and AaBB genotypes (5 marks)
 - State the type of gene interaction in b (i) (1 mark)
- In Drosophila, the gene for red eyes is dominant to that for purple eyes and the gene for grey body is dominant to that for black body. If a grey bodied, red eyed fly is mated with a black bodied, purple eyed fly, the F₁ individuals all have grey bodies and red eyes.

The genes for eye colour and body colour are located on the same chromosome. In Drosophila females, the two genes have an 18% cross over value, but in males, there is no crossing over.

If an F₁ female was back crossed with a black bodied purple eyed male, what proportion of their offsprings would have red eyes and black bodies? (10 marks)

5. a) What is a test cross? (2 marks)
- b) In *Drosophila*, two allelic genes determine body colour and wing length such that normal wing is dominant to vestigial wing and grey body is dominant to ebony body. Workout the expected results of a test cross involving an offspring of the F₁ generation of a cross between two parents homozygous for both alleles. (4 marks)
- c) i) State the expected phenotypic ration of a cross between a vestigial winged grey fly heterozygous for body colour mated to a long ebony fly heterozygous for wing length. (3 marks)
ii) What proportion of these will be long winged? (1 mark)
6. In cats, short hair is dominant over long hair, the gene involved is autosomal. Another gene which is sex linked produces hair colour, its alleles produce black or white coat colour and the heterozygote combination produces tortoise shell colour.
- a) If a long haired black male is mated with a tortoise shelled female homozygous for short hair, what kind of offsprings will be produced in the F₁ generation? (4 marks)
- b) i) If the F₁ cats are allowed to interbreed freely among themselves, what are the chances of obtaining long haired males? (5 marks)
i) Apart from being sex linked, what else can you say about the inheritance of the gene for coat colour? (1 mark)
7. a) Mention any two reasons why Mendel chose to use *Pisum sativum* in his experiments (2 mark)
- c) Manx cats do not have tails. When a manx cat is mated with a normal long tailed cat, approximately half of the offsprings are long tailed and approximately half are short tailed. When two manx cats are mated, the ratio of the offsprings is 2 manx to 1 long tailed cat.
- i) What does this suggest about the interaction of the manx condition in cats? (3 marks)
ii) Show by means of genetic symbols the inheritance of the manx condition when manx cats are mated (5 marks)
8. In domestic poultry, the character of comb is controlled by two genes R for rose comb and P for pea comb. If the dominant allele R is present in the genotype with a dominant P, then a walnut comb is produced. If an individual is homozygous recessive for both alleles, a single comb is produced. If an R is present without a P in the genotype, the comb is rose whereas a P without an R produces a pea comb.
- a) Determine the phenotypic ratio among the offsprings of a cross between two birds whose genotypes are RrPp × Rrpp (6 marks)

- b) A walnut crossed with a single comb produced among the progeny only one single combed offspring. What were the possible genotypes of the parents? Show your reasoning (3 marks)
- c) Suggest a cross between two birds of different comb shapes that produces offsprings among which all the four combs are represented in equal proportions (1 mark)
9. In poultry, feather colour is controlled by two sets of alleles, W (white) dominant over w (coloured) and B (black) dominant over b (brown). A fowl heterozygous for both alleles WwBb is white.
- a) Explain why the genetic constitution of WwBb is white (2 marks)
- b) Work out to show the phenotypic ratio of crossing a white cock (WwBb), with a brown hen (7 marks)
- c) State the possible genotypes of a black fowl (1 mark)

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