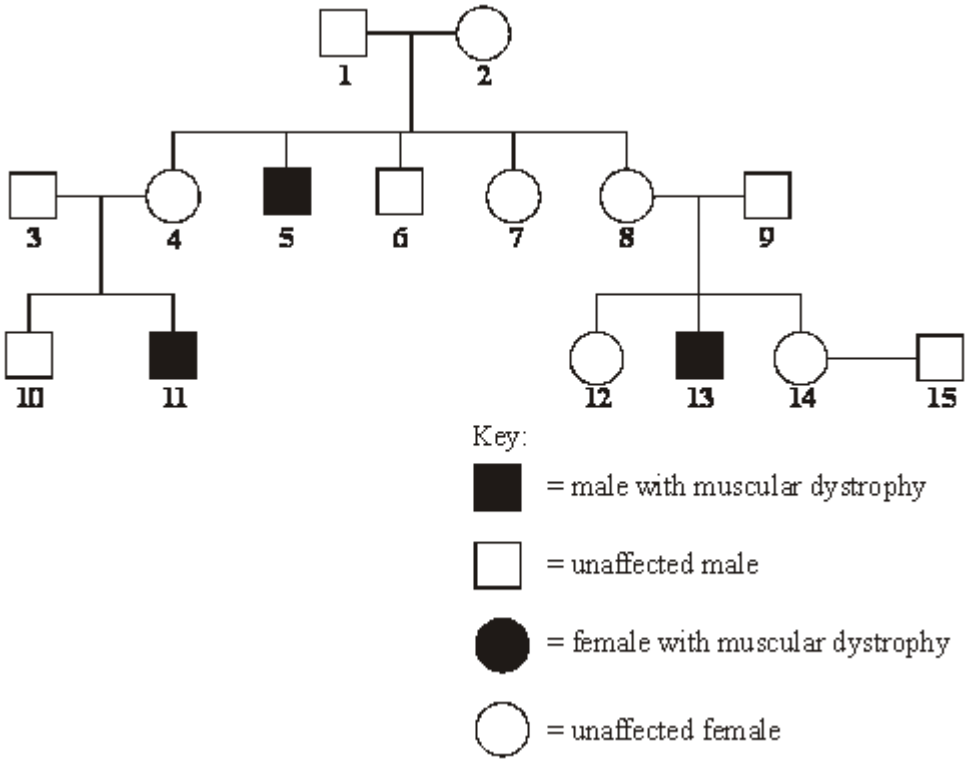
Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Q1.

Duchenne muscular dystrophy is a sex-linked inherited condition which causes degeneration of muscle tissue. It is caused by a recessive allele. The diagram shows the inheritance of muscular dystrophy in one family.



(a) Give evidence from the diagram which suggests that muscular dystrophy is

(i) sex-linked; _____

_____

(1)

(ii) caused by a recessive allele. _____

_____

(1)

(b) Using the following symbols,

$\mathbf{X^D}$ = an X chromosome carrying the normal allele

$\mathbf{X^d}$ = an X chromosome carrying the allele for muscular dystrophy

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Y = a Y chromosome

give **all** the possible genotypes of each of the following persons.

5 _____

6 _____

7 _____

8 _____

(2)

(c) A blood test shows that person **14** is a carrier of muscular dystrophy. Person **15** has recently married person **14** but as yet they have had no children. What is the probability that their first child will be a male who develops muscular dystrophy?

_____

(1)

(Total 5 marks)

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Q2.

Warfarin is a substance which inhibits blood clotting. Rats which eat warfarin are killed due to internal bleeding. Some rats are resistant to warfarin as they have the allele $\mathbf{W^R}$.

Rats have three possible genotypes:

$\mathbf{W^RW^R}$ resistant to warfarin
$\mathbf{W^RW^S}$ resistant to warfarin
$\mathbf{W^SW^S}$ susceptible (not resistant) to warfarin.

In addition, rats with the genotype $\mathbf{W^RW^R}$ require very large amounts of vitamin K in their diets. If they do not receive this they will die within a few days due to internal bleeding.

(a) How can resistance suddenly appear in an isolated population of rats which has never before been exposed to warfarin?

_____

_____

(1)

(b) A population of 240 rats was reared in a laboratory. They were all fed on a diet containing an adequate amount of vitamin K. In this population, 8 rats had the genotype $\mathbf{W^sW^s}$, 176 had the genotype $\mathbf{W^RW^s}$ and 56 had the genotype $\mathbf{W^RW^R}$.

(i) Use these figures to calculate the actual frequency of the allele $\mathbf{W^R}$ in this population. Show your working.

Answer _____

(2)

(ii) The diet of the rats was then changed to include only a small amount of vitamin K. The rats were also given warfarin. How many rats out of the population of 240 would be likely to die within a few days?

_____

(1)

(c) In a population of wild rats, 51% were resistant to warfarin.

(i) Use the Hardy-Weinberg equation to estimate the percentage of rats in this population which would be heterozygous for warfarin resistance. Show your working.

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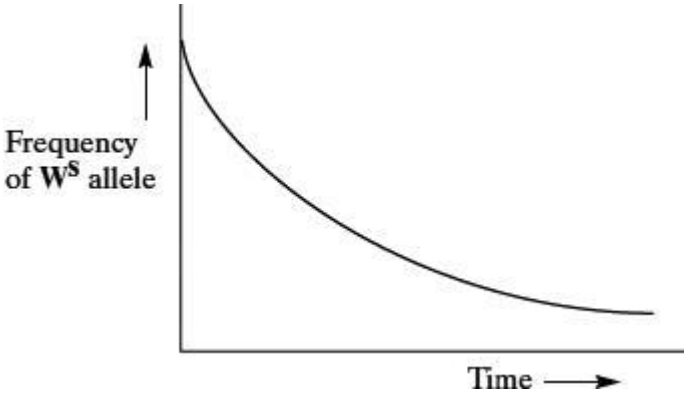
Answer _____ %

(3)

(ii) If all the susceptible rats in this population were killed by warfarin, more susceptible rats would appear in the next generation. Use a genetic diagram to explain how.

(2)

(iii) The graph shows the change in the frequency of the $\mathbf{W^s}$ allele in an area in which warfarin was regularly used. Describe and explain the shape of the curve.



_____

_____

_____

_____

_____

_____

_____

_____

(4)

(iv) Give **two** assumptions that must be made when using the Hardy-Weinberg equation.

1. _____

_____

2. _____

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(2)
(Total 15 marks)

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