

Name of the Student: _____

Max. Marks : 27 Marks

Time : 27 Minutes

Q1.

Hair type in dachshund dogs is controlled by two genes which are on different chromosomes.

Dogs with the **H** allele have wiry hair and dogs with the genotype **hh** have non-wiry hair.

The length of wiry hair is always the same. Dogs with non-wiry hair have either long or short hair. The length of non-wiry hair is controlled by another gene. Dogs with the **D** allele have short hair and those with the genotype **dd** have long hair.

- (a) Give all the possible genotypes for dachshunds with non-wiry, short hair.

(1)

- (b) What type of interaction is occurring between the two genes? Explain your answer.

(2)

- (c) A wiry-haired male with the genotype **HhDd** was mated with a non-wiry, long-haired female with the genotype **hhdd**. Complete the genetic diagram to show the ratio of offspring phenotypes expected in this cross.

<i>Parental phenotypes</i>	Wiry-haired male	Non-wiry, long-haired female
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<i>Parental genotypes</i>	HhDd	hhdd
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<i>Gametes</i>		
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<i>Offspring genotypes</i>		
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<i>Offspring phenotypes</i>		
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<i>Ratio of offspring phenotypes</i>		
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(3)

(Total 6 marks)

Q2.

One form of baldness in humans is controlled by two alleles, **B** and **b**, of a single gene. This gene is not on the X chromosome but the expression of the gene is affected by the sex of a person.

Men who are **BB** or **Bb** will become bald. Men who are **bb** will not become bald.

Women who are **BB** will become bald. Women who are **Bb** or **bb** will not become bald.

One type of colour blindness is controlled by a sex-linked gene, found on the X chromosome. The dominant allele **X^A** leads to normal colour vision and the recessive allele **X^a** leads to colour blindness.

- (a) (i) Give all the possible genotypes of a bald man who has normal colour vision.

(1)

- (ii) Give all the possible genotypes of a woman who will not become bald and who carries one allele for colour blindness.

(1)

- (b) A mother and a father are both heterozygous for the gene for baldness. The father has normal colour vision and the mother is heterozygous for the gene for colour blindness. Complete the genetic diagram to show the probability of a son of this couple being colour blind but not becoming bald.

Father

Mother

Genotypes of parents

Gametes

Genotypes of sons

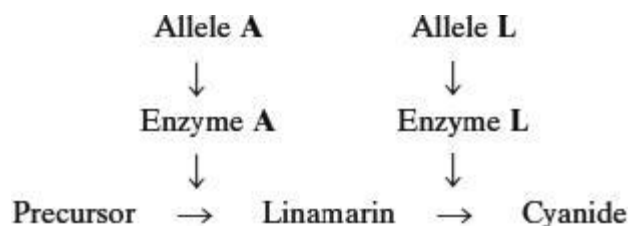
Probability of son being colour blind but not becoming bald _____

(4)

(Total 6 marks)

Q3.

Cyanide is a poisonous substance. Cyanogenic clover plants produce cyanide when their tissues are damaged. The ability to produce cyanide is controlled by genes at loci on two different chromosomes. The dominant allele, **A**, of one gene controls the production of an enzyme which converts a precursor to linamarin. The dominant allele, **L**, of the second gene controls the production of an enzyme which converts linamarin to cyanide. This is summarised in the diagram.



- (a) Acyanogenic clover plants cannot produce cyanide. Explain why a plant with the genotype **aaLL** cannot produce cyanide.

(1)

- (b) A clover plant has the genotype **AaLl**.

- (i) Give the genotypes of the male gametes which this plant can produce.

(1)

- (ii) Explain how meiosis results in this plant producing gametes with these genotypes.

(2)

- (c) Two plants, heterozygous for both of these pairs of alleles, were crossed. What proportion of the plants produced from this cross would you expect to be acyanogenic but able to produce linamarin? Use a genetic diagram to explain your answer.

(3)

In an investigation, cyanogenic and acyanogenic plants were grown together in pots. Slugs were placed in each pot and records were kept of the number of leaves damaged by the feeding of the

slugs over a period of 7 days. The results are shown in **Table 1**.

Table 1

	Undamaged	Damaged
Cyanogenic plants	160	120
Acyanogenic plants	88	192

(d) A χ^2 test was carried out on the results.

(i) Suggest the null hypothesis that was tested.

(1)

(ii) χ^2 was calculated. When this value was looked up in a table, it was found to correspond to a probability of less than 0.05. What conclusion can you draw from this?

(3)

A second investigation was carried out in a field of grass which had been undisturbed for many years. **Table 2** shows the population density of slugs and the numbers of cyanogenic and acyanogenic clover plants at various places in the field.

Table 2

Population density of slugs	Number of acyanogenic clover plants per m ²	Number of cyanogenic clover plants per m ²
Very low	26	10
Low	17	26
High	0	10
Very high	0	5

(e) Explain the proportions of the two types of clover plant in different parts of the field.

(4)
(Total 15 marks)