

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

Clover plants have leaves all through the year. Some clover plants have leaves that produce poisonous hydrogen cyanide gas when damaged. These cyanogenic plants are less likely to be eaten by snails. However, the leaves of these plants can be damaged by frost, resulting in the production of enough hydrogen cyanide to kill the plants. Acyanogenic plants do not produce hydrogen cyanide. This characteristic is genetically controlled.

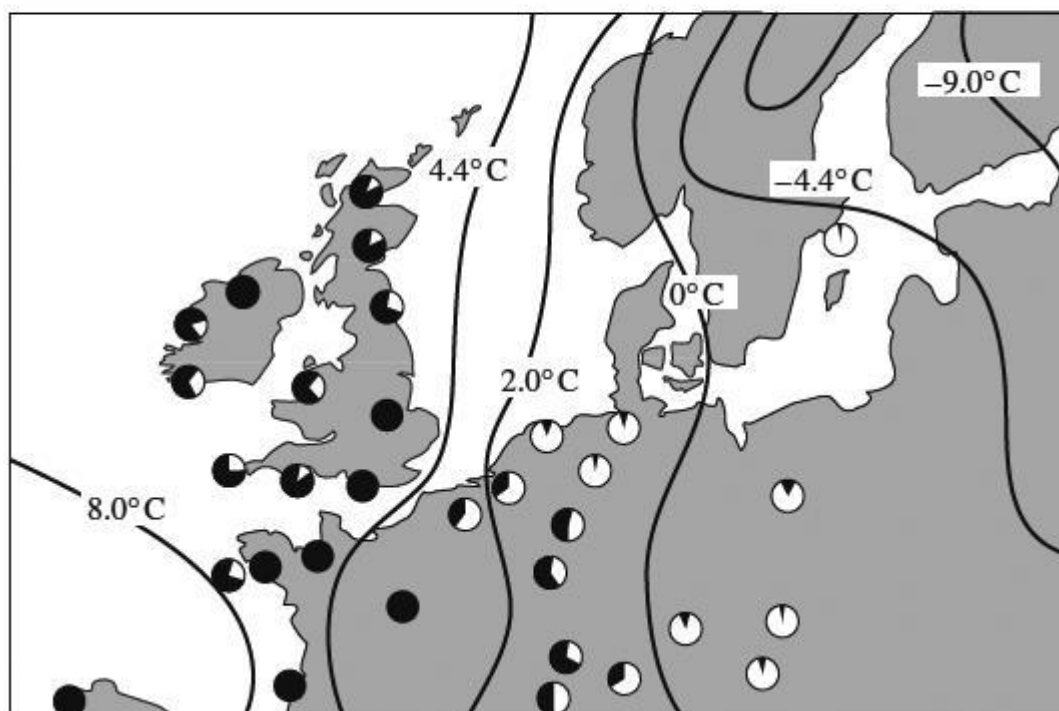
The map shows the proportions of the two types of plant in populations of clover from different areas in Europe. It also shows isotherms, lines joining places with the same mean January temperature.

Key

Black area represents
proportion of plants
able to produce
cyanide (cyanogenic)



White area represents
proportion of plants
not able to produce
cyanide (acyanogenic)



- (a) Explain how different proportions of cyanogenic plants may have evolved in populations in different parts of Europe.

(4)

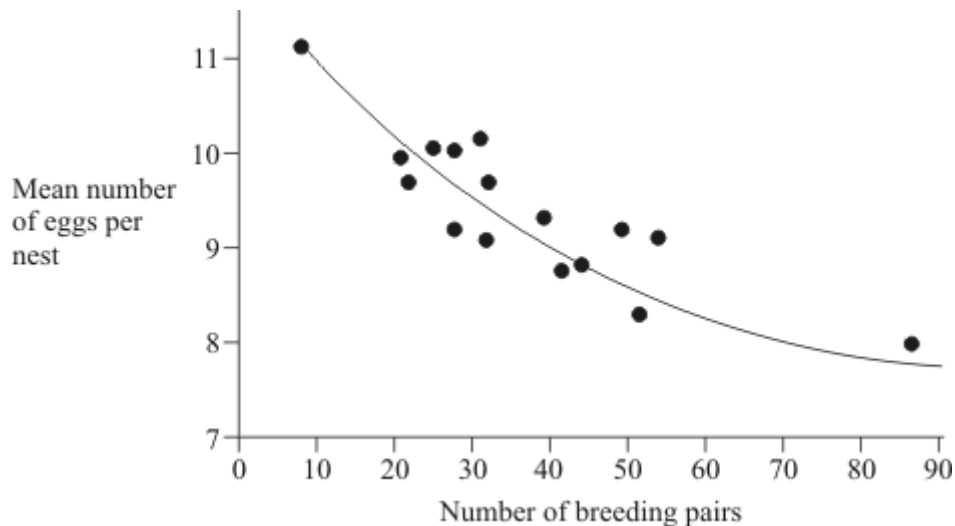
- (b) Differences in cyanide production may affect the total number of clover plants growing in different areas. Describe how you would use quadrats in an investigation to determine whether or not there is a difference in the number of clover plants in two large areas of equal size.

(4)

(Total 8 marks)

Q2.

Great tits are small birds. The graph shows the relationship between the number of breeding pairs in the population and the mean number of eggs per nest in different years in a wood.



- (a) Explain the relationship shown by the graph.

(2)

- (b) Female great tits usually lay between 3 and 14 eggs in a nest.

- (i) In the same year, the birds do not all lay the same number of eggs. Explain how **one** factor, other than the number of breeding pairs, could influence the number of eggs laid by a great tit.

(1)

- (ii) Natural selection influences the number of eggs laid. Explain why great tits that lay fewer than 3 eggs per nest or more than 14 eggs per nest are at a selective disadvantage.

(3)

(Total 6 marks)

Q3.

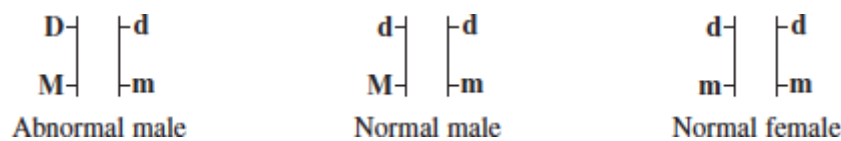
- (a) Explain **one** way in which the behaviour of chromosomes during meiosis produces genetic variation in gametes.

(2)

- (b) In mosquitoes, the sex of an individual is determined by one gene. Males have the genotype **Mm** and females **mm**.

Another gene is carried on the same chromosome. Normal males and females are homozygous **dd** for this gene. Abnormal males have a dominant **D** allele.

The possible genotypes are shown below. The vertical lines represent homologous chromosomes.



During meiosis, allele **D** causes the homologous chromosome carrying the **m** allele to disintegrate. Cells lacking this chromosome do not develop further.

Complete the genetic diagram to show how allele **D** is transmitted from an abnormal male to his offspring.

<i>Parental phenotypes</i>	Abnormal male	Normal female
<i>Parental genotypes</i>	$\begin{array}{c} \text{D} \\ \text{M} \end{array} \begin{array}{c} \\ \end{array} \begin{array}{c} \text{d} \\ \text{m} \end{array}$	$\begin{array}{c} \text{d} \\ \text{m} \end{array} \begin{array}{c} \\ \end{array} \begin{array}{c} \text{d} \\ \text{m} \end{array}$
<i>Gametes</i>		
<i>Offspring genotype(s)</i>		
<i>Offspring phenotype(s)</i>		

(3)

(Total 5 marks)