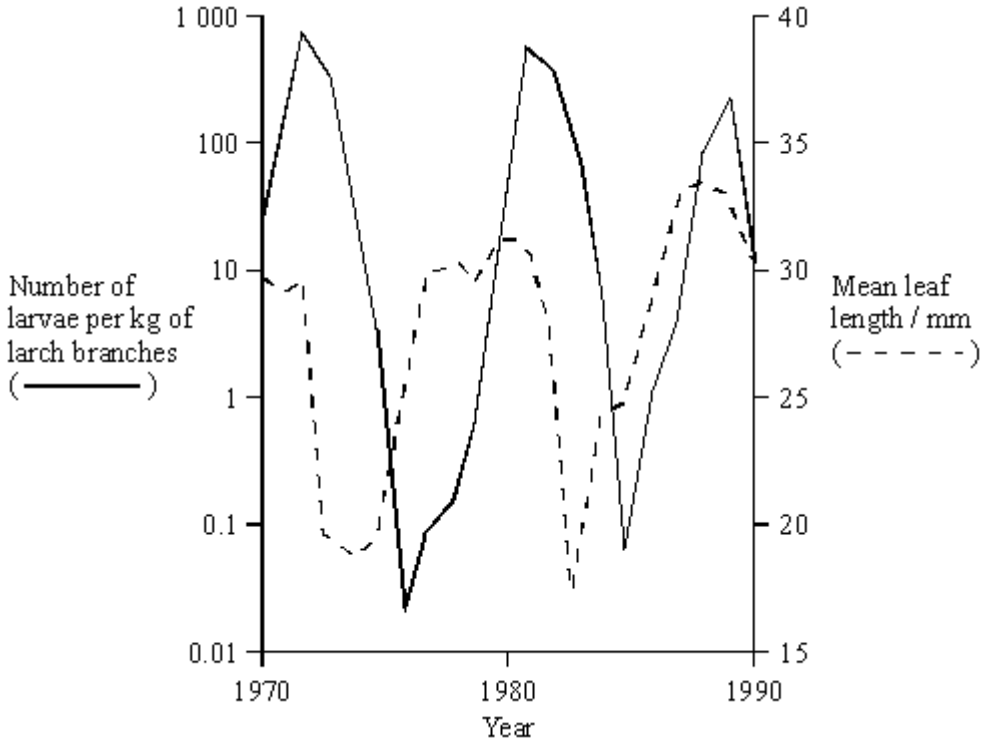
Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Q1.

A species of moth occurs in forests in Switzerland. The moth larvae feed on the needle-shaped leaves of larch trees that grow in the forests. The graph shows the numbers of larvae and the mean length of leaves over a period of 20 years.



(i) Describe how the population size of a species of bird that fed mainly on the moth larvae would be likely to change between 1970 and 1980.

_____

_____

_____

_____

(2)

(ii) Larch trees lose their leaves in autumn. When numbers of larvae are large in one year, the leaves in the following year are shorter. Suggest an explanation for this.

_____

_____

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_____

_____

(2)
(Total 4 marks)

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Q2.

A sex-linked gene controls fur colour in cats. Ginger-coloured fur is controlled by the allele **G**, and black-coloured fur is controlled by the allele **g**. Some female cats have ginger and black patches of fur. They are described as tortoiseshell. Male cats cannot be tortoiseshell.

(a) What is meant by a *sex-linked* gene?

_____

_____

(1)

(b) A male cat with the genotype $\mathbf{X^g\ Y}$ mates with a tortoiseshell female.

(i) Give the phenotype of the male.

_____

(1)

(ii) Give the genotype of the tortoiseshell female.

_____

(1)

(iii) Complete the genetic diagram to show the genotypes and the ratio of phenotypes expected in the offspring of this cross.

Parents Male Tortoiseshell female

Parental genotypes $\mathbf{X^g\ Y}$ _____

P*arental gametes*

Offspring genotypes

Offspring phenotypes

Ratio

(3)

(c) The effect of the **G** and **g** alleles is modified by another gene. This gene is not sex-linked and it has two alleles. The allele **d** changes the ginger colour to cream and the black colour to grey. The dominant allele **D** does not modify the effect of **G** or **g**.

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A cream-coloured male cat mated with a black female whose genotype was **X^gX^g Dd**. Male kittens of two different colours were produced. Complete the genetic diagram.

Parental phenotypes	Cream-coloured male	Black female
Parental genotypes	_____	**X^gX^g Dd**
Parental gametes		
Male kitten genotypes		
Male kitten colours		

(3)
(Total 9 marks)

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Q3.

Figure 1 and **Figure 2** show the chromosomes from a single cell at different stages of meiosis.

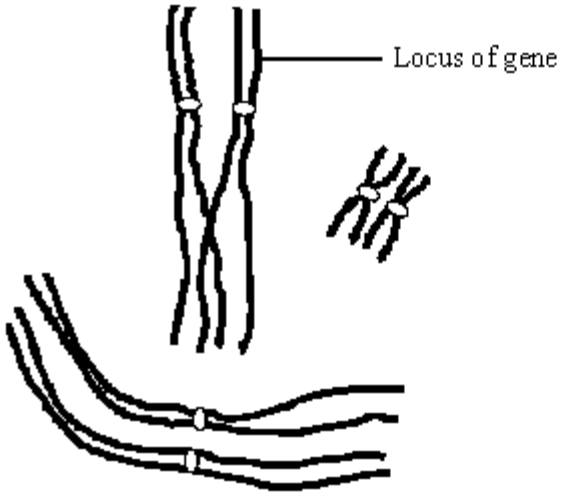

Figure 1

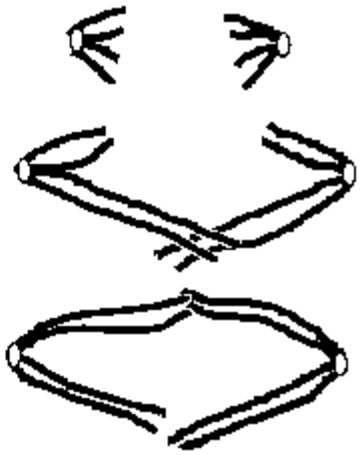

Figure 2

(a) What is the diploid number of chromosomes in the organism from which this cell was taken?

_____

(1)

(b) Describe what is happening to the chromosomes at the stage shown in

(i) **Figure 1**;

_____

_____

_____

_____

(2)

(ii) **Figure 2**.

_____

_____

_____

_____

(2)

(c) (i) The genotype of this organism is **Bb**. The locus of this pair of alleles is shown in **Figure 1**.

Label **two** chromosomes on **Figure 2** to show the location of the **B** allele and the location of the **b** allele.

(1)

(ii) How many genetically different gametes can be produced by meiosis from a cell with the genotype, **Bb Cc Dd**? Assume these genes are located on different pairs of homologous

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chromosomes. Show your working.

_____

(2)
(Total 8 marks)

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