Name of the Student:_____
Max. Marks : 27 Marks **Time : 27 Minutes**

Q1.

There are wolves in many European countries. Scientists investigated the genetic diversity of these wolves. They collected samples of DNA from the mitochondria of wolves from different countries. For each sample they identified which haplotypes were present in the DNA. A haplotype is a particular sequence of bases on DNA. Mutations can produce new haplotypes.

Country	Number of wolves sampled	Number of different haplotypes in mitochondrial DNA
Spain	84	3
Portugal	19	2
Italy	101	1
France	7	1
Bulgaria	29	6
Sweden	93	1

The scientists wanted to find out whether one of the haplotypes in the Portuguese wolves was the same as one of those in the Spanish wolves. They used a restriction endonuclease, electrophoresis and a labelled DNA probe.

(a) For what purpose did they use

(i) the restriction endonuclease

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_____

(1)

(ii) electrophoresis?

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_____

(1)

(b) Explain why the labelled DNA probe could be used to find out whether the haplotypes were the same.

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(2)

(c) The scientists analysed the DNA on the Y chromosome and the DNA in the mitochondria of the Swedish wolves. They concluded that the Swedish wolf population descended from one male wolf from Finland and one female wolf from Russia.

(i) Explain why DNA on the Y chromosome helped them to reach this conclusion.

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_____

(1)

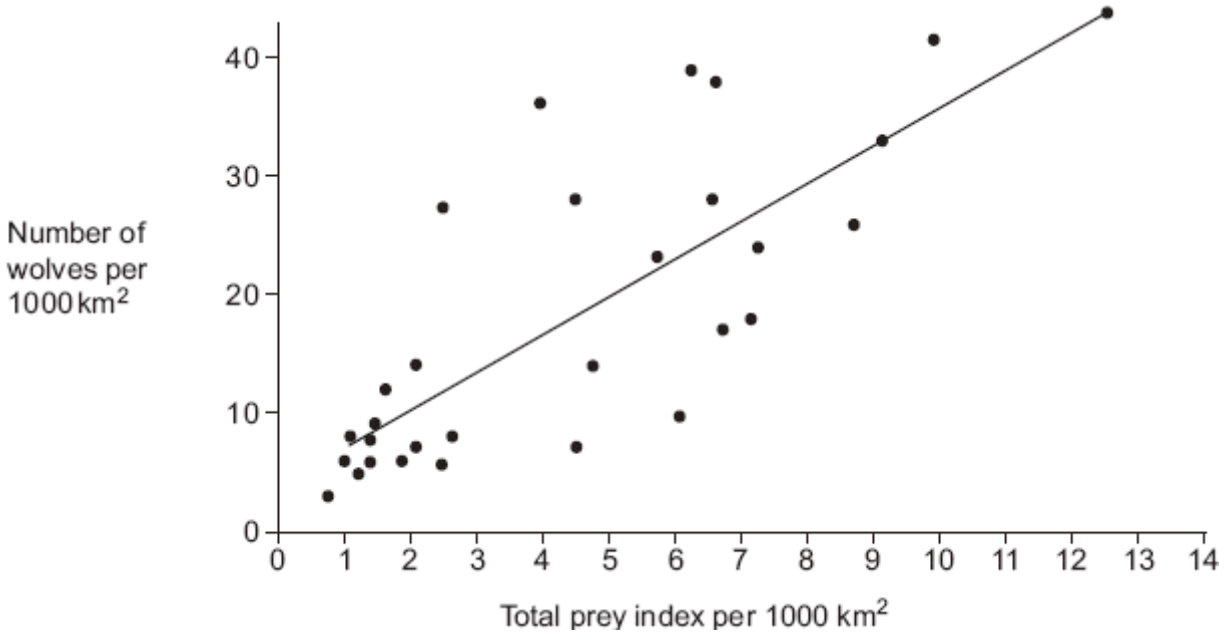
(ii) Suggest why DNA in the mitochondria helped them to reach this conclusion.

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_____

(1)

Wolves eat different mammals. An ecologist investigated factors that affect wolf numbers in North America. He collected data from different field studies carried out in different places. The graph shows his results.



(d) (i) The wolf numbers are given per unit area. Explain why.

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(2)

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(ii) The ecologist calculated the total prey index for each of the places that had been studied. In order to do this, he gave each prey species a value based on how much food was available to wolves from the prey animal concerned. He called this value the prey index.

The ecologist considered that the prey index gave a better idea of the food available than the prey biomass in kg. Suggest why the prey index gives a better idea of food available.

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(2)

(e) The ecologist calculated the total prey index by combining the prey indices and the total number of animals of each species present in 1000 km^2. He plotted this information on the graph. What does the graph suggest about the factors that determine wolf numbers in North America? Explain your answer.

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(2)

(Total 12 marks)

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Q2.

Taxol is a drug used to treat cancer. Research scientists investigated the effect of injecting taxol on the growth of tumours in mice. Some of the results are shown in **Figure 1**.

Figure 1

Number of days of treatment	Mean volume of tumour / mm^3	
	Control group	Group injected with taxol in saline
1	1	1
10	7	2
20	21	11
30	43	20
40	114	48
50	372	87

(a) Suggest how the scientists should have treated the control group.

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(2)

(b) Suggest and explain **two** factors which should be considered when deciding the number of mice to be used in this investigation.

1. _____

_____

2. _____

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(2)

(c) The scientists measured the volume of the tumours. Explain the advantage of using volume rather than length to measure the growth of tumours.

_____

_____

(1)

(d) The scientists concluded that taxol was effective in reducing the growth rate of the tumours over the 50 days of treatment. Use suitable calculations to support this conclusion.

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(2)

(e) In cells, taxol disrupts spindle activity. Use this information to explain the results in the group that has been treated with taxol.

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(3)

(f) The research scientists then investigated the effect of a drug called OGF on the growth of tumours in mice. OGF and taxol were injected into different mice as separate treatments or as a combined treatment. **Figure 2** and **Figure 3** show the results from this second investigation.

Figure 2

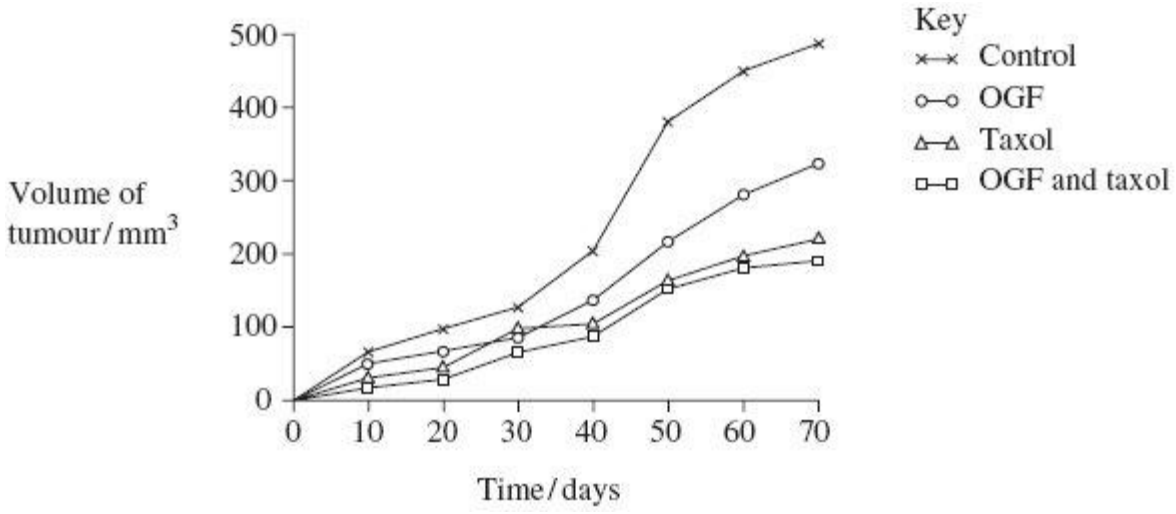


Figure 3

Treatment	Mean volume of tumour following 70 days treatment /mm^3 (± standard deviation)
OGF	322 (± 28.3)
Taxol	207 (± 22.5)
OGF and taxol	190 (± 25.7)

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Control	488 (± 32.4)

(i) What information does standard deviation give about the volume of the tumours in this investigation?

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_____

(1)

(ii) Use **Figure 2** and **Figure 3** to evaluate the effectiveness of the two drugs when they are used separately and as a combined treatment.

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(4)

(Total 15 marks)

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