

Natural and Artificial Selection

Question Paper 3

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Selection and evolution
Sub Topic	Natural and artificial selection
Booklet	Theory
Paper Type	Question Paper 3

Time Allowed : 56 minutes

Score : / 46

Percentage : /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

- (c) Scientists synthesised woolly mammoth haemoglobin in order to investigate whether or not the different haemoglobin was part of the mammoth’s adaptation to a cold climate.

The affinity of haemoglobin for oxygen is affected by the changes in temperature that can occur in mammals, for example in active muscle tissue or close to the skin surface.

It is advantageous for Arctic mammals to have haemoglobin whose affinity for oxygen is only slightly affected by changes in temperature. This is often achieved by using substances called ‘red cell effectors’, which bind to haemoglobin.

Fig. 2.1 compares the effect of temperature on the affinity for oxygen of woolly mammoth and Asian elephant haemoglobin, with and without red cell effectors.

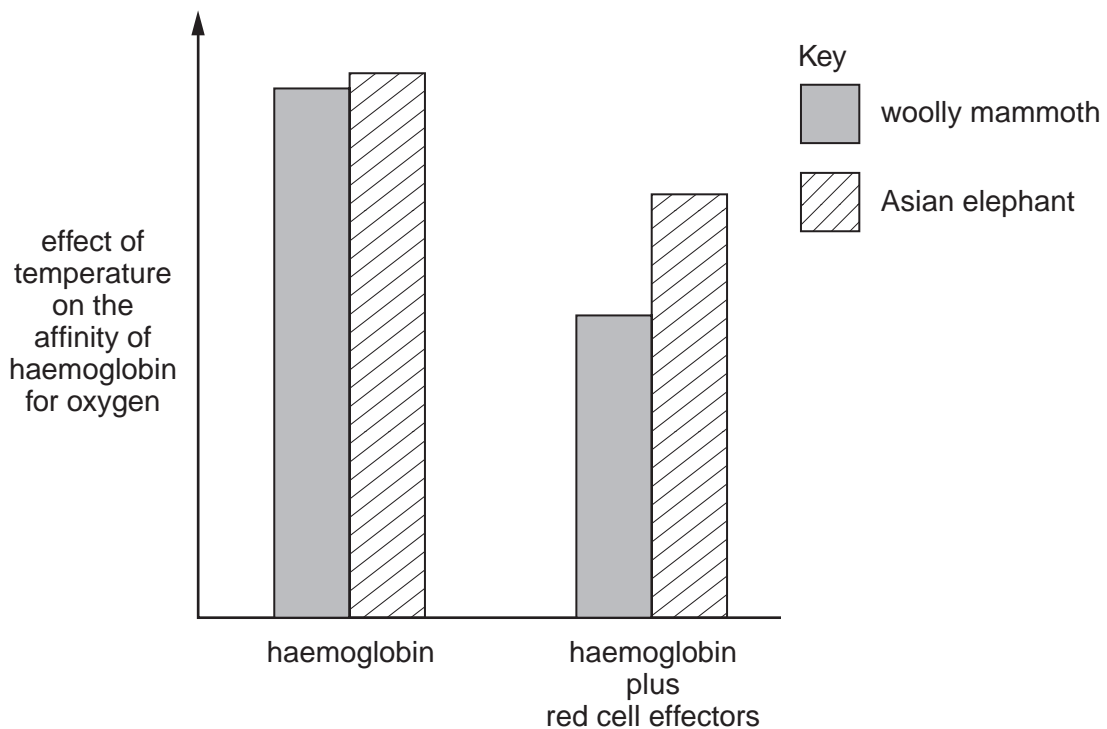


Fig. 2.1

- (i) Suggest why it is advantageous for Arctic mammals to have haemoglobin whose affinity for oxygen is only slightly affected by changes in temperature.

.....

.....

.....

..... [2]

- (c) An experiment was carried out in 1996–1997 to investigate the relative effects of genotype and environment on the yield of maize.

Maize seeds with different ‘inbreeding coefficients’ were used. The greater the inbreeding coefficient, the greater the degree of homozygosity in the maize plants.

Maize seeds with different inbreeding coefficients were planted in two different areas in 1996, and in the same two areas in 1997.

Fig. 5.2 shows the results.

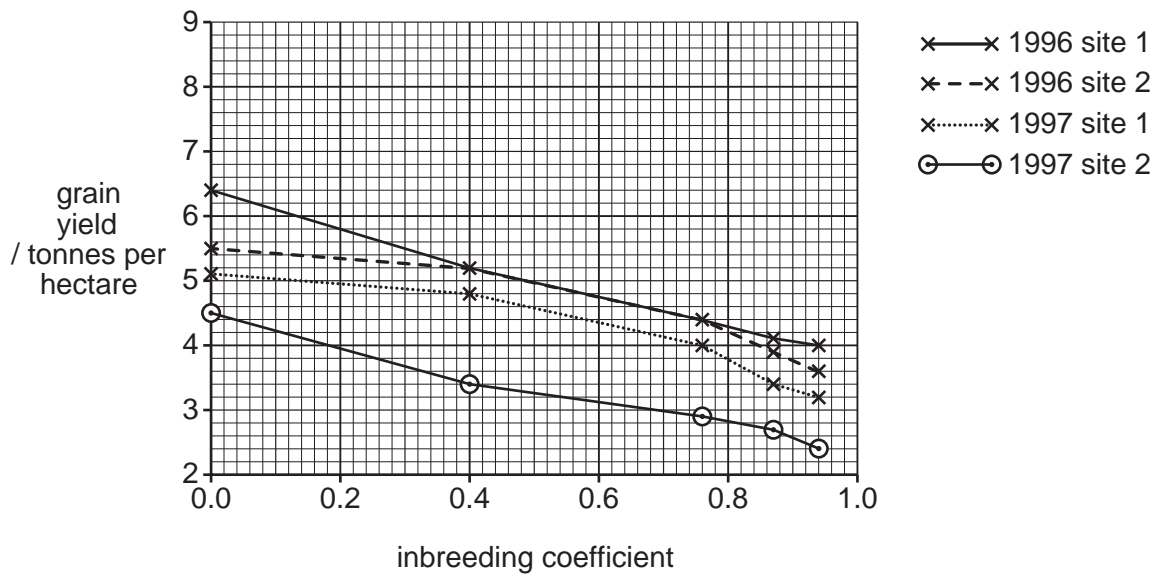


Fig. 5.2

- (i) Inbreeding depression is a reduction in vigour that results from inbreeding.

Explain how the results in Fig. 5.2 demonstrate inbreeding depression in maize.

.....

.....

.....

..... [2]

- (ii) Explain how the results in Fig. 5.2 show that the environment affects maize yields.

.....

.....

.....

..... [2]

Fig. 4.2 shows the results of exposing T65 and C9285 to different concentrations of ethene in dry conditions.

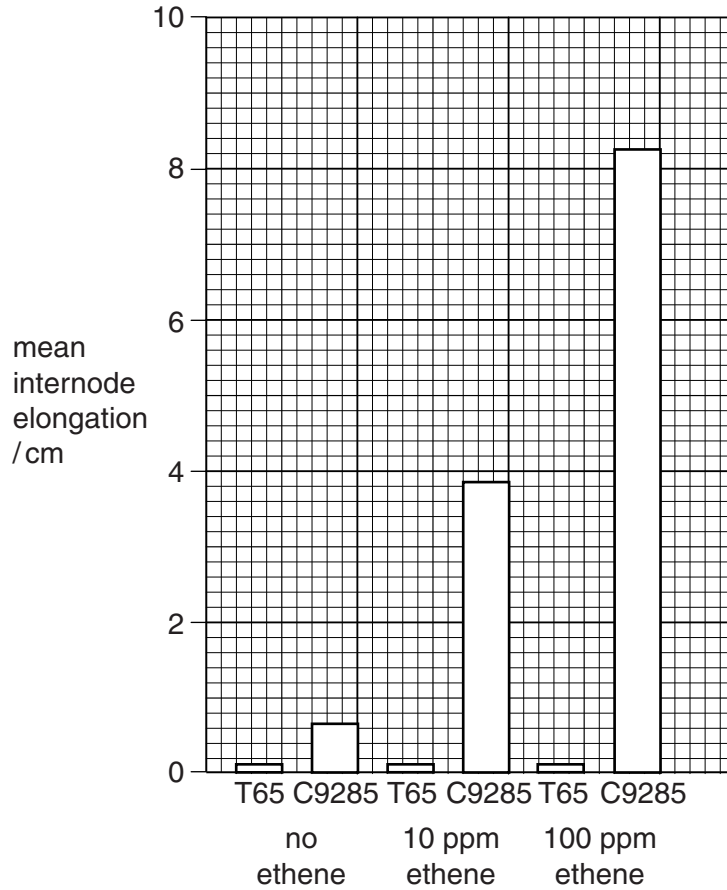


Fig. 4.2

(i) With reference to Fig. 4.1, describe the effect of submergence in water on the production of ethene in rice.

.....

.....

.....

..... [2]

(ii) With reference to Fig. 4.2, compare the effect of ethene on internode elongation in C9285 and T65.

.....

.....

.....

..... [2]

(d) Cultivated rice has been developed from the wild rice species *Oryza rufipogon* and *Oryza nivara*. *O. rufipogon* has a strong deepwater elongation response, but *O. nivara* has only a slight elongation response. Another species, *Oryza glumaepatula*, shows a strong elongation response.

- *O. rufipogon* has both the snorkel genes, *SK1* and *SK2*.
- *O. nivara* has *SK1*, but an addition (insertion) mutation has produced a stop triplet within *SK2*.
- *O. glumaepatula* has *SK2*, but not *SK1*.

(i) Describe what this information indicates about the relative importance of the genes *SK1* and *SK2* in the deepwater elongation response.

.....
.....
.....
..... [2]

(ii) Explain how an addition mutation could produce a stop triplet.

.....
.....
.....
..... [2]

(iii) Deepwater rice is the main food crop in many parts of the world that undergo flooding in the rainy season. Many varieties of deepwater rice have lower yields than non-deepwater varieties.

Suggest how a deepwater rice variety with high yield could be produced, using artificial selection.

.....
.....
.....
.....
..... [3]

4 The following passage is a summary of the main principles of artificial selection.

Some of the words have been omitted.

Write the most appropriate term in each space.

When humans purposefully apply selection to members of a population, the process is known as artificial selection. For example, people have tried to 'improve' their cattle for thousands of years. It is desirable for a dairy farmer to have cows with a high milk yield. The farmer will select cows with high milk yields and mate them with bulls whose have high milk yields. Some of the conferring high milk yield are passed onto their female offspring who are then chosen for breeding. This will continue for many Artificial selection can have disadvantages such as depression which can lead to infertility. [5]

[Total: 5]