

Natural and Artificial Selection

Question Paper 4

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 4

Time Allowed : 59 minutes

Score : / 49

Percentage : /100

Grade Boundaries:

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

- 1 From 1975 to 1977 one of the Galapagos Islands, Daphne Major, experienced a severe drought. A ground finch, *Geospiza fortis*, feeds on seeds on Daphne Major.

Fig. 6.1 shows the ground finch, *G. fortis*.



Fig. 6.1

- One of the few plants that survived the drought produced large seeds inside tough fruits.
- Many *G. fortis* died during the drought and the population declined from 1400 in 1975 to 190 in 1977.
- The mean beak depth of those *G. fortis* that died was 10.68 mm and the mean beak depth of those that survived was 11.07 mm.
- The mean beak depth of *G. fortis* before the drought was 10.86 mm.

- (a) Calculate the percentage decrease in population size between the years 1975 and 1977.

Show all the steps in your calculation and give your answer to the nearest whole number.

Answer % [2]

- (b) Suggest why some *G. fortis* were able to survive the drought while others died.

.....

.....

.....

.....

.....

.....

..... [3]

(c) Natural selection was taking place on Daphne Major.

State the type of natural selection operating on *G. fortis* **during** the drought **and** explain your answer.

type of natural selection

explanation

..... [2]

[Total: 7]

3 Four species of desert pupfish have evolved in the Death Valley region of Nevada since the extensive lakes that existed there were reduced to isolated pools 20 000–30 000 years ago.

(a) Explain how the drying up of an extensive lake system to just a few isolated pools could have resulted in the evolution of four new species of desert pupfish.

.....

.....

.....

.....

.....

.....

.....

.....[4]

(b) Indicate how environmental factors can act as stabilising forces of natural selection in an isolated pool after the initial evolution of a new species.

.....

.....

.....

.....

.....[3]

(c) Suggest what may happen if water levels rose and the isolated pools once more formed an extensive lake system.

.....

.....

.....[2]

[Total : 9]

- (ii) Most crops have a PE of 1% to 4%. Sugar cane, an important crop plant for food production and for the production of biofuel, has a PE of 7% to 8%.

Suggest the advantages of growing crops with high PE for food production or for biofuel.

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

- (iii) Fertilisers containing nitrate are added to improve or maintain yield of crops such as sugar cane.

Name two organic compounds containing nitrogen that are made by plants and state one function of each in plant growth.

organic compound 1

function

.....

organic compound 2

function

.....

.....[2]

[Total: 12]

- 5 The Italian agile frog, *Rana latastei*, lives in woodlands in northern Italy. The adults breed by laying eggs in water in spring. The eggs hatch into tadpoles, which grow and develop for several weeks, before metamorphosing (changing) into adults and leaving the water. This must take place before cool weather arrives in autumn.

Fig. 4.1 shows an adult agile frog.



Fig. 4.1

This frog is now an endangered species. Many woodlands have been destroyed, leaving only isolated patches in which small populations of the frogs live. In order to try to prevent some of these small populations dying out completely, it has been suggested that tadpoles from larger populations could be introduced into the small populations, in order to increase genetic diversity.

- (a) Suggest why increasing genetic diversity could help to conserve populations of Italian agile frogs.

.....

.....

.....

.....

.....

.....

.....

.....

[3]

- (b)** An argument against introducing individuals from one population into another is that there may be genetic differences between them that have evolved in response to exposure to different selection pressures. These genetic differences could be lost.

An investigation was carried out into the time it takes for tadpoles to develop into frogs in two groups of populations:

- populations living in the cool foothills of mountains
- populations living in the warmer lowlands.

- (i)** Frogs, like all amphibians, are not able to control their body temperatures. In the wild, tadpoles in the foothills take about one month longer to develop into adult frogs than tadpoles in the lowlands.

Suggest why tadpoles in the foothills take longer to develop into adults than tadpoles in the lowlands.

.....

.....

.....

.....

..... [2]

- (iii) Explain how the results shown in Fig. 4.2 suggest that there are **genetic** differences between the foothill populations and the lowland populations of agile frogs.

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

- (iv) Suggest how these genetic differences may be important in increasing the chances of survival of the foothill populations in their natural habitat.

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

- (c) With reference to the evidence from this investigation, explain why it may **not** be good conservation policy to introduce tadpoles of agile frogs from lowland populations to foothill populations.

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

[Total: 14]