Variation and Selection

Question Paper 2

Level	IGCSE
Subject	Biology
Exam Board	CIE
Topic	Variation and Selection
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 2

Time Allowed: **60 minutes**

Score: **/50**

Percentage: **/100**

1 Reed warblers are small birds that migrate over long distances between western Africa and northern Europe.

Fig. 5.1 shows a reed warbler, *Acrocephalus scirpaceus*.

Fig. 5.1

(a) State three characteristic features of birds that are visible in Fig. 5.1.

1 .....

2 .....

3 ..... [3]

A study was carried out in Sweden into the effects of natural selection on wing length in reed warblers.

The wings of young reed warblers reach their maximum length a few days after leaving the nest.

At this age the wing length in millimetres of each bird was recorded. Each bird was identified by putting a small ring around one of its legs.

When the birds were caught in net traps as adults, the information on the rings was used to identify specific birds and their ages.

The length of time between ringing and trapping was recorded for each bird that was identified before it was released.

The mean age at trapping was calculated for birds with each wing length.

The results are shown in Table 5.1.

Table 5.1

wing length at ringing / mm	number of birds trapped	mean age at trapping / days
63 or less	24	253
64	72	256
65	1	297
66	1	346
67	1	349
68	1	270
69	66	237
70 or more	23	199
	total = 771	

(b) (i) Explain why wing length is an example of continuous variation.

.....

.....

.....

..... [2]

(ii) Suggest a feature of reed warblers, **other than wing length**, that shows continuous variation.

..... [1]

(c) The researchers concluded that reed warblers with a wing length of 66-67 mm had the best chance of survival.

(i) Describe the evidence from Table 5.1 that supports this conclusion.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(ii) The researchers also suggested that more evidence was needed to make this conclusion.

Suggest what other evidence would show that birds with wings 66-67 mm in length have the best chance of survival.

.....

.....

.....

.....

.....

..... [3]

(d) Scientists have discovered that genes are responsible for wing length in reed warblers. The most common length of wing has been 66-67 mm for many generations of these birds.

Explain how natural selection may be responsible for maintaining the mean wing length of reed warblers at 66-67 mm.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 17]

2 The Food and Agriculture Organization (FAO) collects data on food supplies worldwide.

The FAO classifies the causes of severe food shortages as either by natural disasters or as the result of human action.

Natural disasters are divided into those that occur suddenly and those that take a long time to develop. Human actions are divided into those that are caused by economic factors and those that are caused by wars and other conflicts.

Fig. 6.1 shows the changes in the number of severe food shortages between 1981 and 2007.

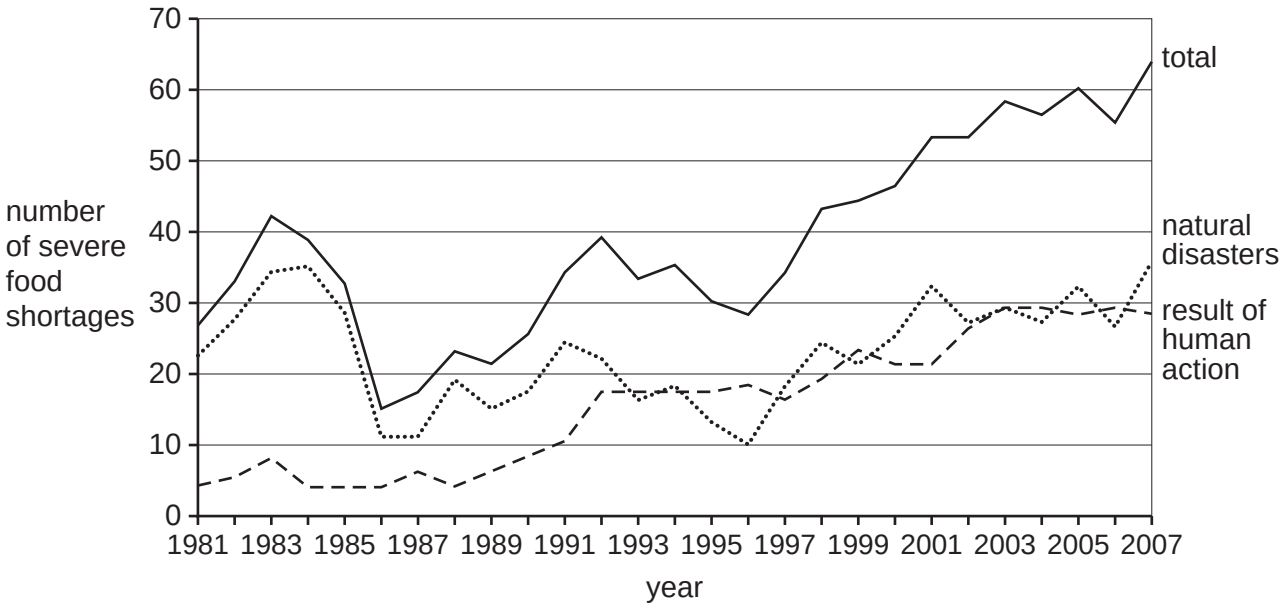

Fig. 6.1

Fig. 6.2 shows the causes of severe food shortages in the 1980s, 1990s and 2000s.

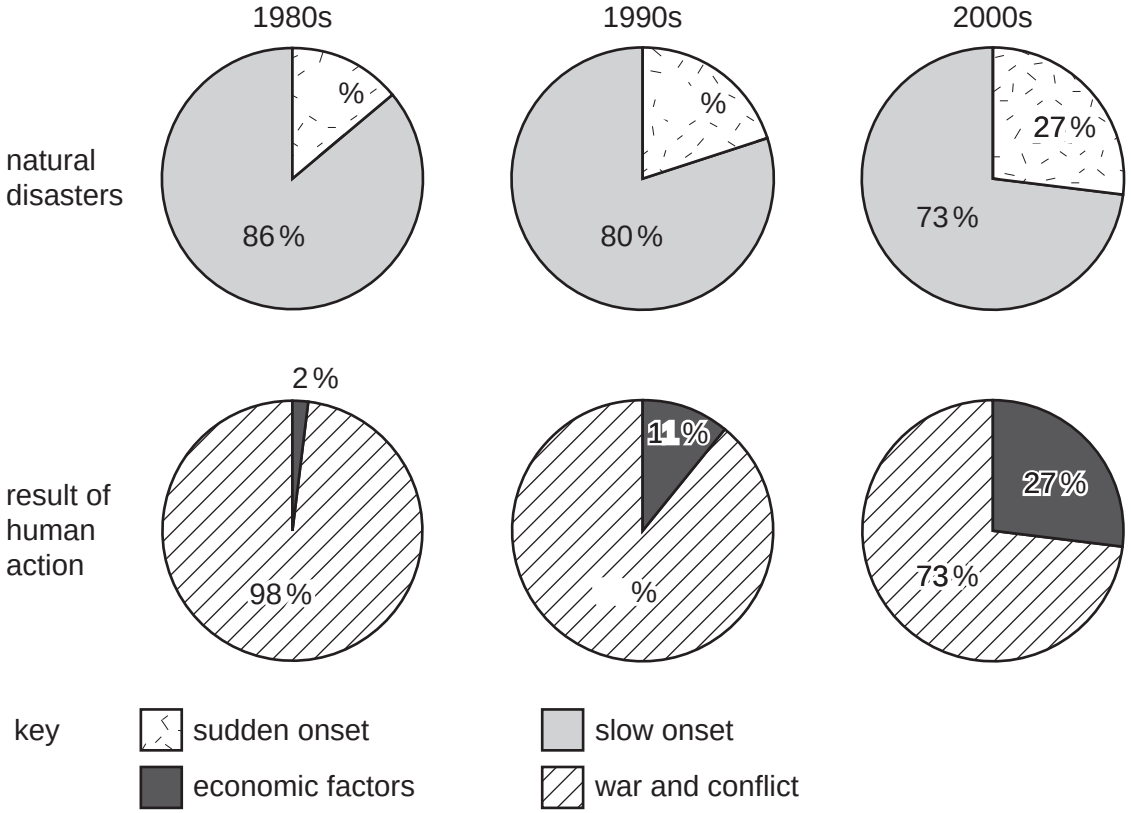

Fig. 6.2

(a) State two types of natural disaster that occur suddenly and may lead to severe food shortages.

1. .....

2. ..... [2]

(ii) State **one** type of natural disaster that may take several years to develop.

..... [1]

(b) Use the information in Fig. 6.1 and Fig. 6.2 to **describe** the changes in food shortages between 1981 and 2007.

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(c) Explain how the increase in the human population may contribute to severe food shortages.

.....

.....

.....

.....

.....

..... [3]

The quality and quantity of food available worldwide has been improved by artificial selection (selective breeding) and genetic engineering.

(d) Use a **named** example to outline how artificial selection is used to improve the quantity or quality of food.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(e) Define the term *genetic engineering*.

.....

..... [1]

[Total: 16]

3 Fig. 4.1 is a photograph of a root of radish covered in many root hairs.

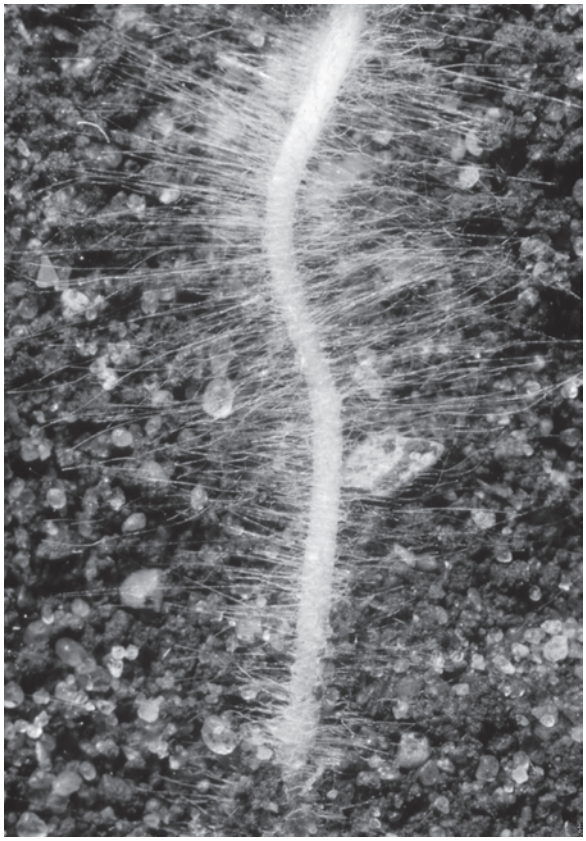

Fig. 4.1

(a) Using the term *water potential*, explain how water is absorbed into root hairs from the soil.

.....

.....

.....

.....

.....

..... [3]

A potometer is a piece of apparatus that is used to measure water uptake by plants.

Most of the water taken up by plants replaces water lost in transpiration.

A student used a potometer to investigate the effect of wind speed on the rate of water uptake by a leafy shoot. As the shoot absorbs water the air bubble moves upwards.

The student's apparatus is shown in Fig. 4.2.

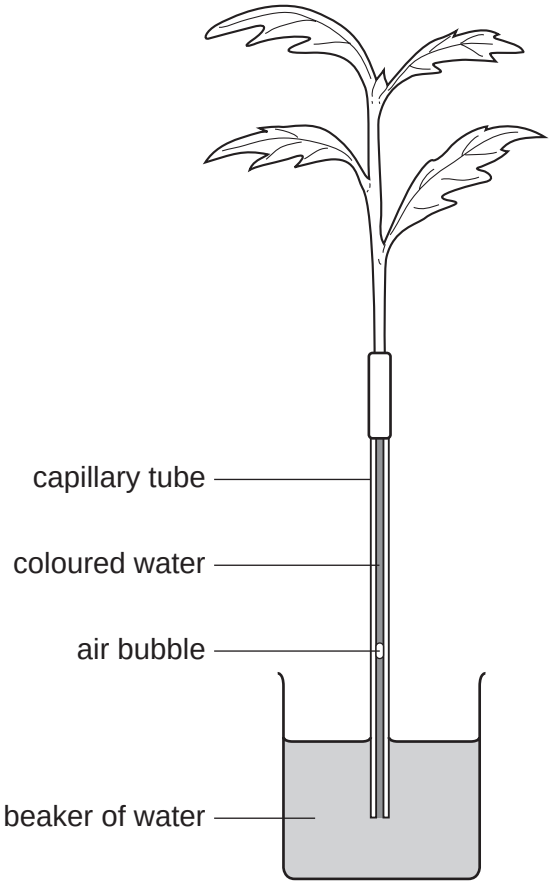

Fig. 4.2

The student used a fan with five different settings and measured the wind speed. The results are shown in Table 4.1.

Table 4.1

wind speed / metres per second	distance travelled by the air bubble / mm	time / minutes	rate of water uptake / mm per minute
0	4	10	0.4
2	12	5	2.4
4	20	5	4.0
6	35	5	7.0
8	40	2	……

(b) Calculate the rate of water uptake at the highest wind speed and write your answer in the table.

[1]

(c) Describe the effect of increasing wind speed on the rate of water uptake. You may use figures from Table 4.1 to support your answer.

.....

.....

.....

..... [2]

(d) State two environmental factors, **other than wind speed**, that the student should keep constant during the investigation.

1. .....

2. ..... [2]

(e) Some of the water absorbed by the plants is **not** lost in transpiration.

State two **other** ways in which water is used.

1. .....

2. ..... [2]

(f) Water moves through the xylem to the tops of very tall trees, such as giant redwoods of North America. The movement of water in the xylem is caused by transpiration.

Explain how transpiration is responsible for the movement of water in the xylem.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(g) Plants that live in hot, dry environments show adaptations for survival.

State three **structural** adaptations of these plants.

1. .....

2. .....

3. ..... [3]

[Total: 17]