Classification

Question Paper 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Biodiversity, classification and conservation
Sub Topic	Classification
Booklet	Theory
Paper Type	Question Paper 2

Time Allowed : **74 minutes**

Score : **/ 61**

Percentage : **/100**

Grade Boundaries:

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

1 **(a)** Fig. 4.1 shows the structure of a male flower of maize, *Zea mays*.

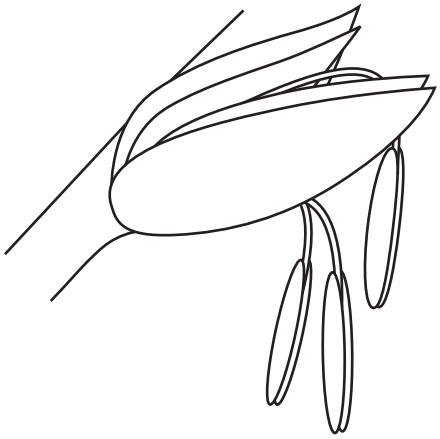

Fig. 4.1

With reference to Fig. 4.1, explain how **two** features of this flower adapt it for wind pollination.

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(b) The corn borer, *Ostrinia nubilalis,* is an insect pest of maize. The larvae are caterpillars that eat the leaves of the maize plants. The adults can fly. Adult corn borers do not feed on maize plants.

Much of the maize that is grown in the USA has been genetically modified to produce *Bt* toxin, which is lethal to insects that feed on the leaves. However, many populations of the corn borer have now evolved resistance to the *Bt* toxin.

Explain how this resistance could have evolved.

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(c) The recessive allele, **r**, of the gene in corn borers confers resistance to *Bt* toxin. Larvae that are homozygous for the normal, dominant allele **R**, or that are heterozygous, are killed when they feed on *Bt* maize**.**

State the genotype of the corn borers that successfully turn from larvae into adults in the fields where *Bt* maize is grown.

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(d) In order to reduce the number of corn borers resistant to *Bt* toxin, farmers in the USA are required to grow up to 50% of their maize as non-*Bt* varieties. The non-*Bt* maize is grown in separate areas, called 'refuges', close to the fields of *Bt* maize. This is called the HDR strategy.

Almost all corn borer larvae feeding on this non-*Bt* maize have the genotypes **RR** or **Rr**. The HDR strategy assumes that, when these become adults, they will interbreed with the adults developing in the *Bt* maize fields.

Explain how the HDR strategy could reduce the proportion of corn borers that are resistant to the *Bt* toxin.

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(e) The HDR strategy works only if a high proportion of the adult corn borers developing in the *Bt* fields mate with adult corn borers from the non-*Bt* refuges. An investigation was carried out to determine the extent to which female corn borers mate with males from their own field, or from outside that field.

- Several hundred male and female adult corn borers were marked and then released into a maize field that contained no corn borers.
- After 36 hours, as many corn borers as possible were recaptured from the field and the number of marked and non-marked male and female corn borers was recorded.
- The percentage of the marked females that had mated with marked males was also recorded.
- This was repeated on four more occasions.

The results are shown in Table 4.1.

Table 4.1

trial	percentage of recaptured males that were marked	percentage of recaptured females that were marked	percentage of marked females that had mated	percentage of marked females that had mated with marked males
1	30	19	96	10
2	43	96	100	38
3	67	83	90	67
4	25	9	67	50
5	18	21	100	35

(i) With reference to the two shaded columns in Table 4.1, explain what the results indicate about the degree of mixing between corn borers from different fields.

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(ii) With reference to Table 4.1, suggest and explain the implications of the results of this investigation for the effectiveness of the HDR strategy.

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[Total: 15]

2 A significant quantity of the metallic copper produced in some countries is obtained using the chemoautotrophic bacterium, *Thiobacillus ferro-oxidans*, which is present in rocks in many countries.

The process, known as bioleaching, is shown in Fig. 5.1.

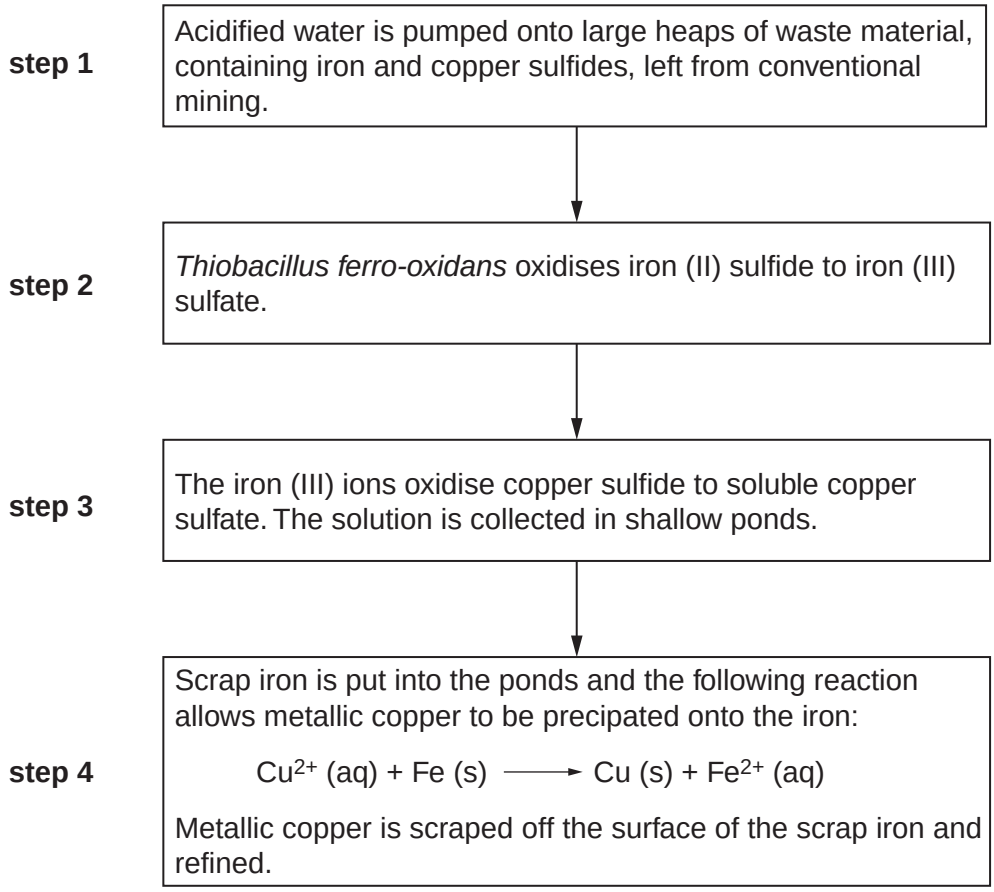

Fig. 5.1

(a) Suggest the benefit to the bacterium of **step 2**.

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(b) State two environmental disadvantages of extracting metals by bioleaching.

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(c) Explain why the production of metallic copper by bioleaching can be cheaper than using conventional mining methods.

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[Total: 8]

3 **(a)** Describe the main features of an organism belonging to the plant kingdom. [7]

(b) Describe the structure of a mitochondrion and outline its function in a plant cell. [8]

[Total: 15]

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4 Corals are simple marine animals and usually exist in colonies of thousands of individuals.

Fig. 7.1 shows a coral colony.

Fig. 7.1

Corals absorb calcium carbonate from the sea to build their skeletons, which help to form large coral reefs. Coral reefs provide a home for about 25% of known fish species and have the highest biodiversity of any marine ecosystem.

(a) Corals, although they are animals, are sometimes mistaken for members of the plant kingdom.

State **two** ways in which corals differ from plants.

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(b) Outline what is meant by the term *ecosystem.*

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(c) Coral reefs are at risk of damage due to human activities. All the coral reefs in three regions were classified as being at low, medium or high risk of damage.

Table 7.1 shows the areas of coral reef at risk of damage in these three regions.

Table 7.1

region	area of coral reef at risk of damage / 1000 km^2			percentage of coral reef at high risk of damage
	low	medium	high	
Caribbean Sea	9	8	7	29
Indian Ocean	20	15	10	
Pacific Ocean	60	30	9	

(i) Complete Table 7.1, giving your answers **to the nearest whole number**. [1]

(ii) Suggest how human activities could damage coral reefs.

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[Total: 8]

5 **(a)** Explain the need to maintain biodiversity in an ecosystem such as a tropical rainforest.[7]

(b) Discuss the advantages and the disadvantages of captive breeding programmes for mammals. [8]

[Total: 15]

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