

Natural and Artificial Selection

Question Paper 2

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 2

Time Allowed : 68 minutes

Score : / 56

Percentage : /100

Grade Boundaries:

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

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3 (a) Explain, **with one example**, how a mutation may affect the phenotype of an organism.

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A mutation of the gene for the β polypeptide chain of haemoglobin can result in sickle cell anaemia, a lethal or near lethal condition.

Only people who are homozygous for this allele have sickle cell anaemia.

All haemoglobin is affected in people who have sickle cell anaemia.

At low oxygen levels red blood cells are distorted (sickle shape) which leads to blockage of capillaries and the destruction of many red blood cells by phagocytosis leading to severe anaemia.

Fig. 4.1 shows the distribution of malaria and the sickle cell allele.

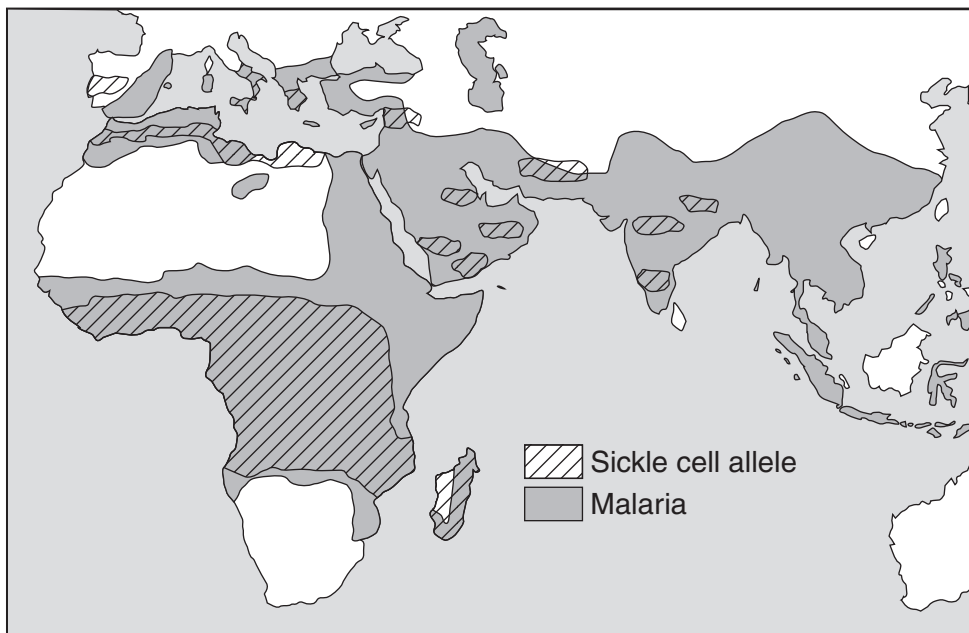


Fig. 4.1

(b) Explain why the sickle cell allele occurs at such high frequencies in some areas.

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[Total: 8]

4 (a) Distinguish between phenotype and genotype.

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.....[2]

(b) Describe how artificial selection differs from natural selection.

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.....[3]

(c) Define the terms

(i) *gene*;

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.....[2]

(ii) *allele*.

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.....[3]

[Total : 10]

- 5 (a) All modern breeds of dog belong to the same species and are thought to have originated from 14 ancient breeds by the process of artificial selection. The golden retriever is a modern breed that is often used as a guide dog for people who are blind or visually impaired.

Fig. 1.1 shows a golden retriever.



Fig. 1.1

Explain how the principles of artificial selection would have been used to produce golden retrievers with the characteristics required for a guide dog.

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- (b) The domestic dog, *Canis familiaris*, is found worldwide. It is able to breed with all other members of the genus to form fertile hybrids.

The distribution of some of the species belonging to the genus *Canis* is shown in Fig. 1.2.

The dingo and the grey wolf species have distinct ranges but the ranges of three species of jackal overlap in East Africa.

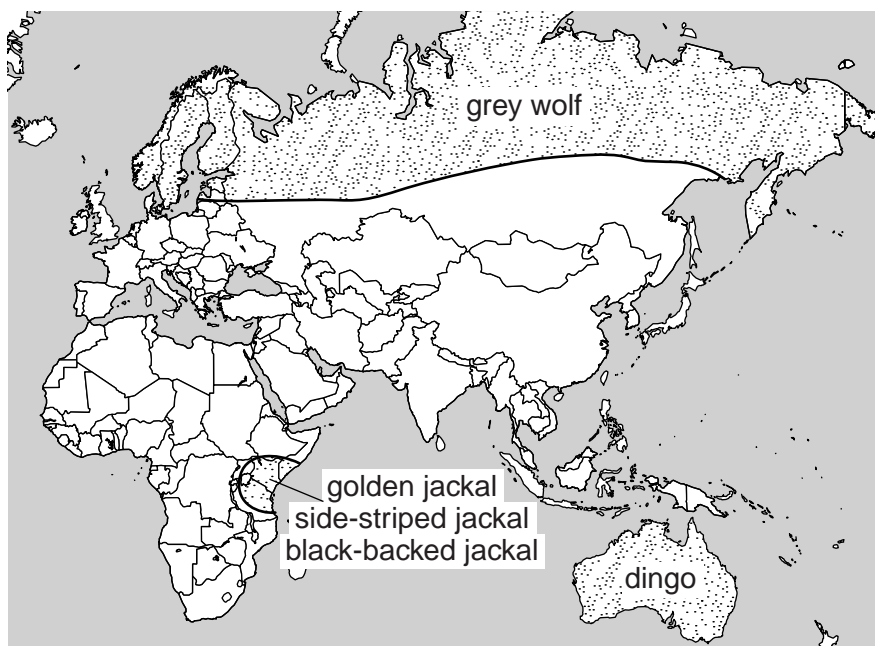


Fig. 1.2

Table 1.1 shows whether members of different species of the genus *Canis* are able to breed with each other.

Table 1.1

key: ✓ = able to interbreed ✗ = unable to interbreed ? = interbreeding unknown

	dingo	grey wolf	golden jackal	side-striped jackal	black-backed jackal	domestic dog
dingo	✓	?	?			✓
grey wolf	?	✓	?	?		✓
golden jackal	?	?	✓	✗	✗	✓
side-striped jackal	?	?	✗	✓		
black-backed jackal	?	?	✗	✗	✓	✓
domestic dog	✓	✓	✓			

(i) Suggest the type of isolating mechanism **preventing**:

- the three species of jackal interbreeding

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- the dingo mating with all the other members of the genus *Canis* apart from the domestic dog.

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(ii) Using the information in Fig. 1.2 and Table 1.1, state:

- **one** reason why the members of the genus *Canis* could be described as one species

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- **one** reason why they should be described as separate species.

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[Total: 8]