

Natural and Artificial Selection

Question Paper 5

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 5

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%

- (i) Describe the effect of altitude on the frequency of the haemoglobin alleles in these populations of deer mice.

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..... [2]

- (ii) The partial pressure of oxygen is relatively low at high altitudes. Haemoglobin containing glycine at position 64 in the α -polypeptide chain has a higher affinity for oxygen than haemoglobin with aspartic acid at this position.

Suggest how natural selection could account for the difference in allele frequency in deer mice living at high altitudes and low altitudes.

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[Total: 8]

- 2 (a) The summer squash plant produces fruit that are either white or yellow in colour and are either shaped like a disc or a sphere. The dominant phenotypes are white and disc-shaped fruit. Using the symbols **A** for white and **a** for yellow and **B** for disc and **b** for sphere, draw a genetic diagram to show what proportion of offspring will have yellow and sphere-shaped fruit if a white and disc-shaped fruit plant, heterozygous for both genes, is self-fertilised.

Sickle cell anaemia is a blood disease that is frequently fatal when homozygous. It is caused by an autosomal recessive allele. Heterozygotes have sickle cell trait and appear normal.

Malaria is a potentially fatal infectious disease of the blood caused by the protoctist, *Plasmodium*. In parts of the world where malaria is endemic the frequency of the sickle cell allele is high.

(b) Explain the possible health consequences, in such areas, for a person who is homozygous dominant and for a person who is homozygous recessive for the sickle cell allele.

(i) homozygous dominant for the sickle cell allele

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.....[1]

(ii) homozygous recessive for the sickle cell allele.

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.....[1]

(c) Explain why heterozygotes have a strong selective advantage in areas where malaria occurs.

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[Total: 11]

(c) Explain the role of isolating mechanisms in the evolution of new species.

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[Total: 15]

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