

Answers to end-of-chapter questions

Chapter 19: Variation and natural selection

- 1 species, discontinuous, genes, continuous, mutation, adapted
- 2 a Genetic variation is caused by differences in the alleles in different individuals. It can be inherited. Environmental variation is caused by an organism's environment and cannot be inherited. Genetic variation is often discontinuous, and environmental variation is often continuous.
- b In continuous variation, an individual can fit anywhere within a range of a particular characteristic, with no sharp dividing lines. In discontinuous variation, there are a small number of distinct categories into which any individual fits.
- c Natural selection is the increased chances of individual organisms with particular variations surviving and reproducing in their environment, because of selection pressures that act on them. Artificial selection is the choice, by humans, of individuals with particular variations to be allowed to breed together.
- 3 a Sexual reproduction allows mixing of alleles from different parents. There is genetic variation in the population. Different combinations of alleles may give different features that make some individuals better able to survive and reproduce in the changing environment than their parents. Asexual reproduction, however, produces offspring with the exactly the same combinations of alleles as their parent; there is no genetic variation.
(In both sexual and asexual reproduction, mutation may occur, which could form new alleles that might give an advantage to an organism, and be selected for. This is no more likely in sexual than in asexual reproduction.)
- b Mutation may produce new alleles that were not present before. Although mutations usually produce new characteristics that are less good than the normal ones, just occasionally a new feature that gives an organism a survival advantage may occur. If so, then this will be selected for (its owners will be more likely to survive and reproduce) and passed on to the next generation.
- 4 a correct answer given (you will need to get someone to check!); [1]
- b i shape of ear lobes shows discontinuous variation;
so it is caused by genes;
it is not a sex-linked characteristic; [max 2]
- ii approximately 3:1;
free : attached; [2]
- iii allele for free ear lobes likely to be dominant;
and allele for attached ear lobes likely to be recessive;
not codominance as no intermediates. [max 2]
- 5 a beak;
feathers;
wings; [3]
- b there are no distinct categories;
individuals can have any wing length within the range from 63 or less to 70 or more; [2]
- ii *for example:* body mass / body length / beak length; [1]

c i the largest number of birds trapped has wing lengths of 66 or 67 cm;
suggesting that most birds had these wing lengths;
comparative data quoted for birds with these wing lengths and others;
birds with these wing lengths had greater mean ages when trapped;
suggesting that they lived longer than others;
comparative age data quoted for birds with these wing lengths and others; [max 4]

ii repeat measurements for a larger number of birds;
repeat in countries other than Sweden;
check wing lengths of birds that are breeding;

follow individual marked birds throughout their lives to measure wing length and length of life;

measure the wing length of dead birds; [max 3]

d birds with this wing length survive for longer;
more likely to reproduce;
than birds with smaller wings;
wing length determined by, genes / alleles;
which are passed on to offspring; [max 4]