

GCSE Biology (9 – 1)

Variation and Evolution

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/4
2	/10
3	/6
4	/12
5	/10
6	/6
7	/12
8	/6
Total	/66
%	
Grade	

Information

- The maximum mark for this paper is 66 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



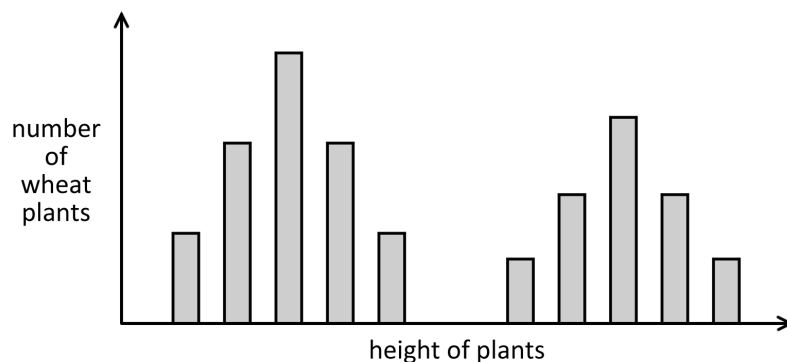
1. Variation and evolution are fundamental concepts in biology; the following questions examine different facets of these interconnected processes. Circle the letter of the correct answer for each.

a) Which of the following is **not** a feature of natural selection?

- A production of many offspring
- B competition for resources
- C variation within the population
- D selection by humans

(1 mark)

b) The bar chart shows the heights of wheat plants grown from 1000 wheat seeds.



What form of variation do the wheat seeds show when they grow?

- A continuous variation and discontinuous variation.
- B neither continuous variation nor discontinuous variation.
- C continuous variation only.
- D discontinuous variation only.

(1 mark)

c) Discontinuous variation results in individuals fitting into clear, distinct categories for a particular characteristic. Which human trait listed below is best described this way?

- | A | B | C | D |
|-----------|--------|---------------|-------------|
| Body mass | Height | Width of hand | Blood group |
- (1 mark)

d) The theory of evolution by natural selection, which explains how species adapt and change over generations, was independently proposed by which pair of scientists?

- A Gregor Mendel and Jean-Baptiste Lamarck
- B Charles Darwin and Alfred Russel Wallace
- C Carl Linnaeus and Gregor Mendel
- D Charles Darwin and Jean-Baptiste Lamarck

(1 mark)

(Total for Question 1 is 4 marks)

2. Soay sheep live on St. Kilda, a group of small, remote islands near Scotland that have very cold, windy, and rainy weather. Sheep were first brought there thousands of years ago, and today's Soay sheep come from them. People stopped living on St. Kilda in 1930, so the sheep now live wild and are not farmed.

The figure below shows a typical Soay sheep.



- a) Suggest **one** observable physical trait that likely shows variation within the Soay sheep population on St. Kilda?

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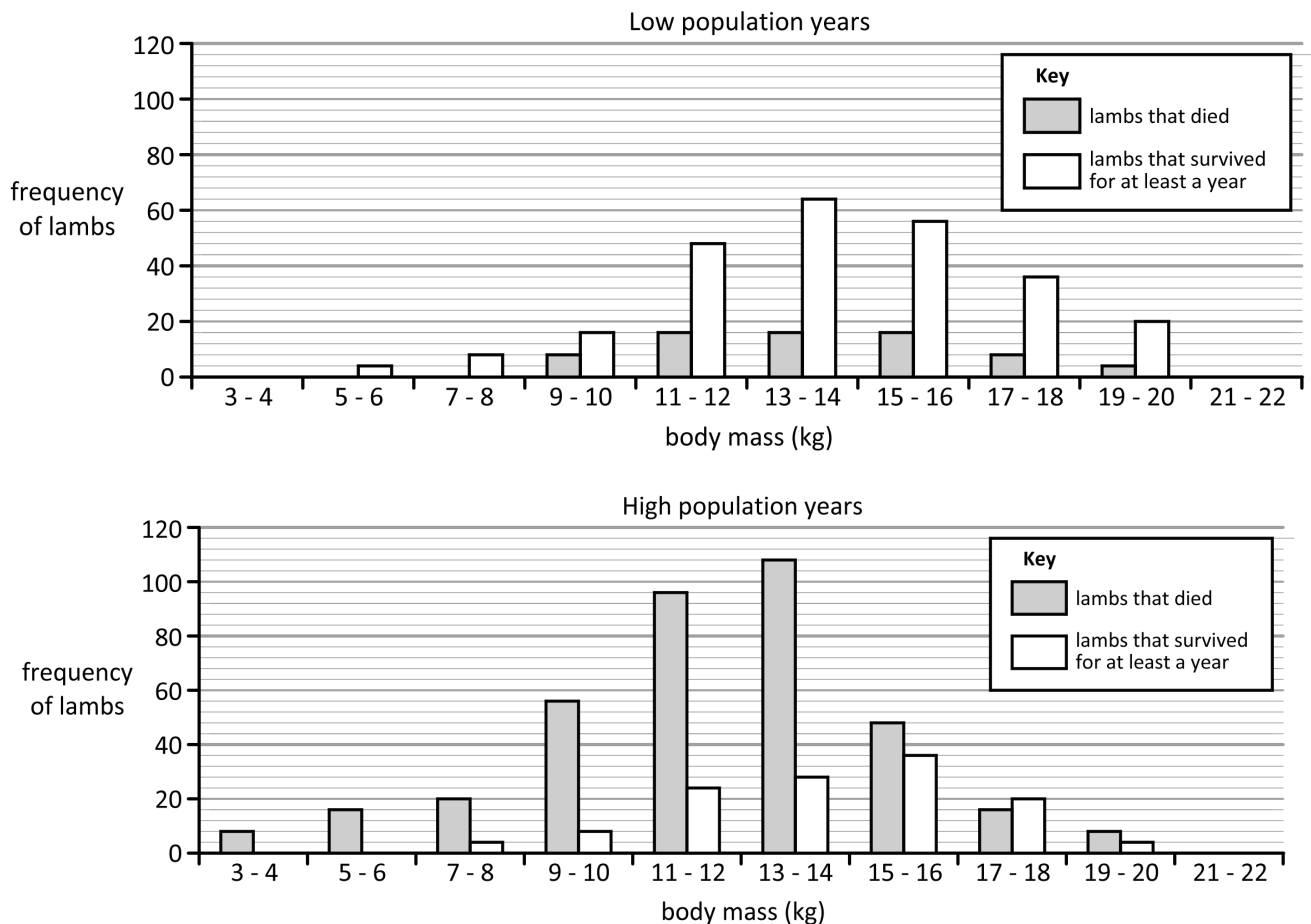
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(1 mark)

For many years, ecologists tracked Soay sheep and lamb numbers on St. Kilda. Between 1985 and 1996, lambs were caught, marked, and weighed annually. The total sheep population on St. Kilda fluctuated, being lower in some years than others.

The figure below compares the frequency of different lamb body masses in years with low total sheep numbers versus years with high total sheep numbers.



- b) The figure above contains information about lambs when the St. Kilda sheep population is large versus small. How does this information show that population size strongly influences lamb survival?

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(2 marks)

- c) Suggest an explanation for the effect that you have described.

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(3 marks)

- d) How can the theory of natural selection explain the evolution of the adaptive traits observed in Soay sheep living under the extreme conditions of St. Kilda?

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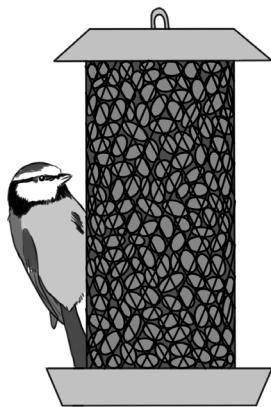
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(4 marks)

(Total for Question 2 is 10 marks)

3. Blue tits, small birds commonly observed in gardens, are often fed nuts by people in the UK using bird feeders, such as the one depicted in the diagram below.



- a) Given that UK blue tits (which frequently use bird feeders) have slightly longer beaks than blue tits in the rest of Europe (where feeders are rare), explain, using Charles Darwin's theory of natural selection, how the availability of bird feeders could have driven this evolutionary change in beak length.

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(4 marks)

- b) If the design of commonly used bird feeders in the UK changed such that very short beaks became more advantageous for accessing nuts, predict what would happen to the average beak length of the UK blue tit population over many generations. Explain your reasoning.

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(2 marks)

(Total for Question 3 is 6 marks)

4. The Marsh Harrier, a magnificent and stunningly beautiful bird of prey, is a notable inhabitant of the UK's wetland ecosystems.

The numbers of Marsh Harriers dropped dramatically in the 19th Century. This was due to both a loss of wetlands and persecution by humans.



It is now illegal to harm these remarkable animals and a lot of work has been done to restore much of the lost wetland habitat.

In 1995, it was estimated that number of breeding pairs of Marsh Harriers in the UK was 160 pairs. Most recent estimates in 2024 suggest that there could be now 600 breeding pairs in the UK.

- a) Calculate the percentage increase in the number of breeding pairs from 1995 to 2024.

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(3 marks)

The Marsh Harrier is superbly adapted to hunting small animals within dense wetland habitats like reedbeds. These birds often fly relatively slowly and low while searching an area for prey.

- b) Explain, using the principles of natural selection, how the evolution of **broad wings** in Marsh Harriers would be advantageous for their survival and reproduction in this specific environment.

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(3 marks)

Although Marsh Harrier numbers have recovered significantly in the UK, if the current population was found to be largely descended from a very small number of individuals (and therefore closely related), this could make them susceptible to future extinction.

- c) Explain, using your knowledge of natural selection, why being closely related could increase the Marsh Harriers' susceptibility to extinction.

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(3 marks)

Marsh Harriers, like all species, show variation within their population.

- d) Identify two distinct types of observable physical variation that might be present among individual Marsh Harriers in the UK.

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(2 marks)

- e) Choose one of the variations you identified in (d) and explain how it could potentially provide an advantage to an individual Marsh Harrier.

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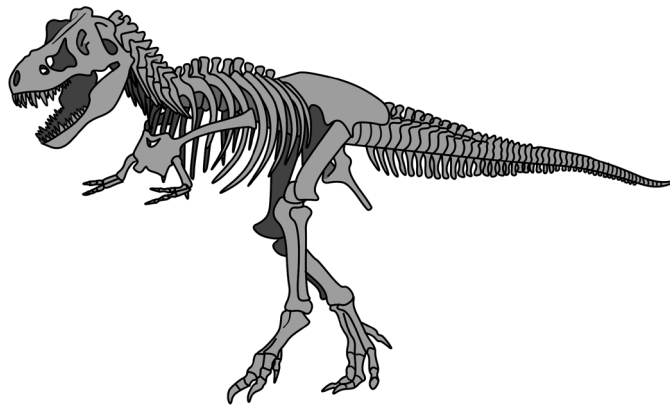
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(1 mark)

(Total for Question 4 is 12 marks)

5. Skeletons of Tyrannosaurus rex show a large dinosaur, characterised by a massive skull packed with huge teeth, powerful hind legs, and disproportionately tiny, two-fingered forelimbs.

The figure below shows the skeleton of a Tyrannosaurus Rex.



- a) Explain why fossils of dinosaurs like Tyrannosaurus Rex are often found to be incomplete.

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(3 marks)

The figure below shows four different Stone Age tools discovered at different archaeological sites throughout Europe.



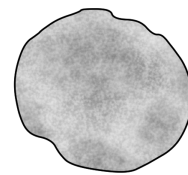
handaxe



arrowhead



cutting stone



hammer stone

- b) Suggest how these tools may have helped early humans to survive.

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(2 marks)

- c) In the context of human evolution, explain why mitochondrial DNA is often chosen over nuclear DNA as a source of evidence.

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(2 marks)

- d) How does the fossil record provide evidence for the evolutionary changes that have occurred in the human lineage over time?

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(3 marks)

(Total for Question 5 is 10 marks)

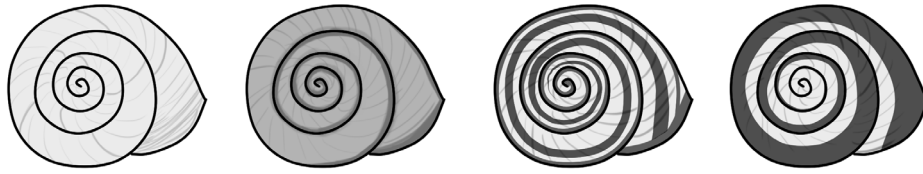
6. Explain Darwin's theory of evolution by natural selection.

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dotted lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.

(6 marks)

(Total for Question 6 is 6 marks)

7. A group of students investigated variation in a species of snail, *Cepaea nemoralis*.
The snails show variation in the colour of their shells and whether their shells have dark bands or not.
The figure below shows examples of *Cepaea nemoralis* snail shells.



- a) State what is meant by the term 'variation'.

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(1 mark)

- b) Give **two** causes of variation in organisms.

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(2 marks)

The students collected 50 snails from a woodland area and 50 snails from a grassland area.
They recorded the shell colour and the presence or absence of bands for each snail.
Their results for the woodland area are shown in the table below.

Shell Feature	Number of Snails
Yellow shell	8
Pink shell	6
Brown shell	36
Total	50

- c) The students concluded that shell colour in *Cepaea nemoralis* is an example of discontinuous variation.
Explain why the data in Table 1 supports this conclusion.

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(2 marks)

- d) Calculate the percentage of snails from the woodland area that had a **brown** shell.
Show all of your working.

Percentage = ...
(2 marks)

In the grassland area, the students found a higher proportion of snails with yellow, banded shells compared to the woodland area.

- e) Suggest an environmental factor that could cause this difference in the proportion of yellow, banded snails between the two areas. Explain your answer.

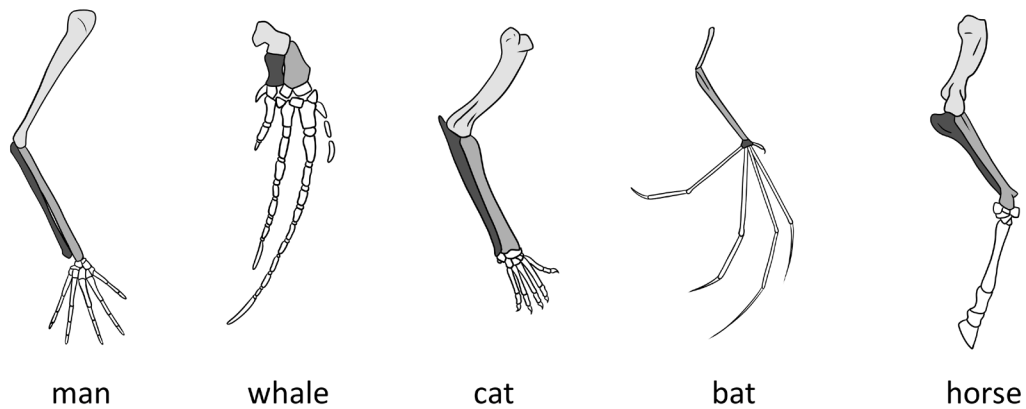
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(3 marks)

- f) Variation can be caused by sexual reproduction.
Describe how sexual reproduction leads to variation in offspring.

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(2 marks)

(Total for Question 7 is 12 marks)

8. The diagram shows some limbs of modern-day animals.



Scientists study the anatomy of limbs across a wide range of vertebrate species, from the wing of a bat to the flipper of a whale and the leg of a horse. They often find fundamental similarities in the bone arrangements despite different appearances and uses.

Explain in detail how these observations of limb structures in different vertebrates provide significant evidence to support the theory of evolution.

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(6 marks)

(Total for Question 8 is 6 marks)