1. In East Africa, elephants are hunted for their tusks.

Scientists have found that:

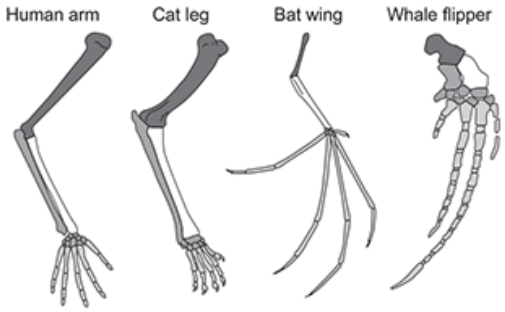
- occasionally female elephants are born without tusks,
- the absence of tusks is caused by a mutated dominant allele,
- the allele for an absence of tusks is lethal if inherited by a male embryo.

Explain why the number of tuskless elephants is rapidly increasing in East Africa.

Explain also why the spread of this allele may have negative effects on the elephant population.

[6]

2. Why are the different structures of these limbs evidence for evolution?



A Differences in the limb bones show that humans, cats and bats evolved from whales.
B Evolution is a random process producing similar structures for different functions.
C The limbs have a similar structure as the organisms all shared a common ancestor.
D The limbs have all evolved from a common ancestor to perform the same function.

Your answer ☐ **[1]**

3(a). Sorghum is a crop plant grown in Africa for its seeds.

Sorghum produces a bitter chemical in its seeds.

Birds do not like the taste of this chemical. Some people also find the taste unpleasant.

Explain how sorghum could have evolved to produce the bitter chemical.

[3]

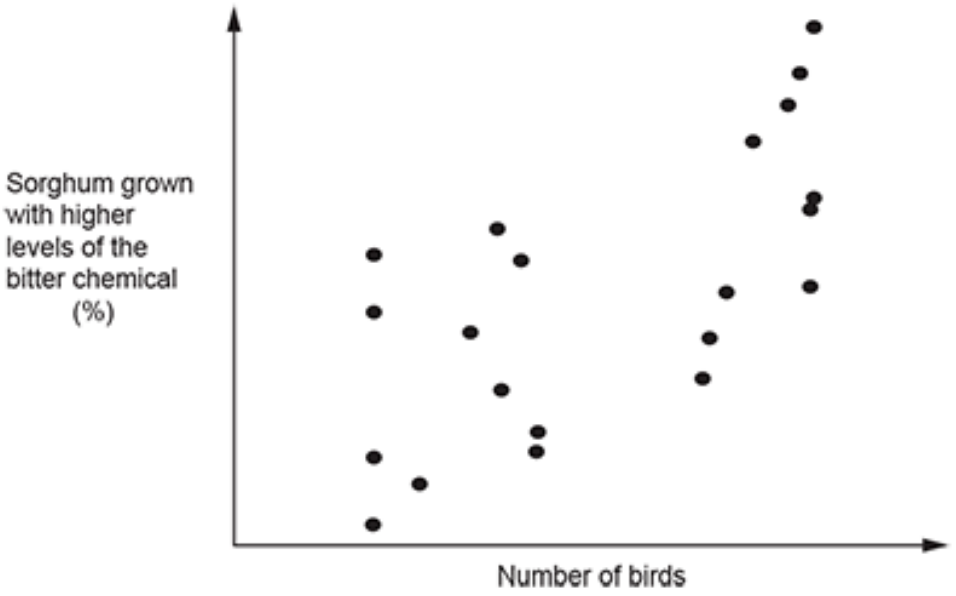
(b). In some areas in Africa, farmers have been growing varieties of sorghum that have lower levels of a bitter chemical.
These varieties have been produced by artificial selection.

Describe how the process of artificial selection is carried out.

[2]

(c). Scientists recorded the types of sorghum grown in different areas of Africa that have higher levels of the bitter chemical.
They also recorded the number of birds that eat sorghum living in the same areas.

The graph shows their results.



Suggest an explanation for the pattern of results shown in the graph.

_____

_____

_____ **[2]**

4(a). The table shows the mean mass of four types of rodent and the mean number of years they live.

Type of rodent	Mean mass (g)	Mean number of years they live
Gerbil	40	1.5
Guinea pig	1000	4.0
Rat	200	2.0
Squirrel	600	3.0

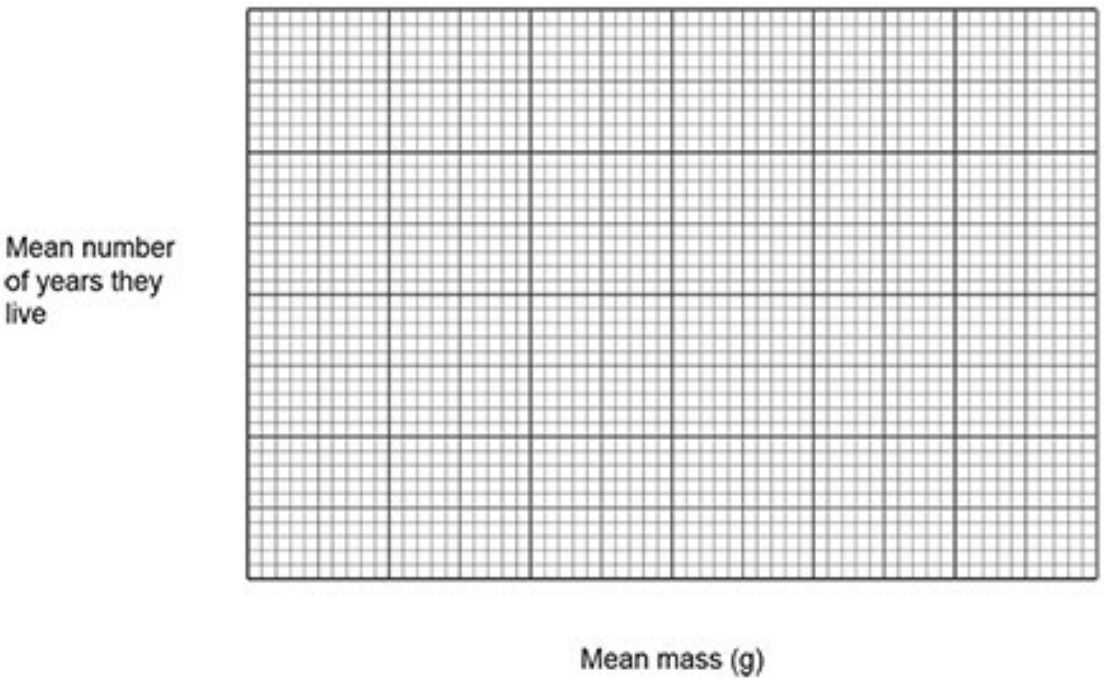
i. Choose suitable scales and plot the data from the table onto the graph.

[3]

ii. Draw a line of best fit through the points.

[1]

(b).



Mole rats are rodents that live in Africa.

The mean mass of a mole rat is 60 g and they live for about 18 years.

Use the graph you drew in the previous question part to explain what is unusual about the mole rat data compared to other rodents.

[2]

(c). Mole rats are rodents that live in Africa. Mole rats spend most of their life burrowing underground in tunnels. Some tunnels have only 5% oxygen in the air compared with 21% above ground.

Scientists have found that the mole rats have several unusual features compared to other rodents.

The mole rats have:

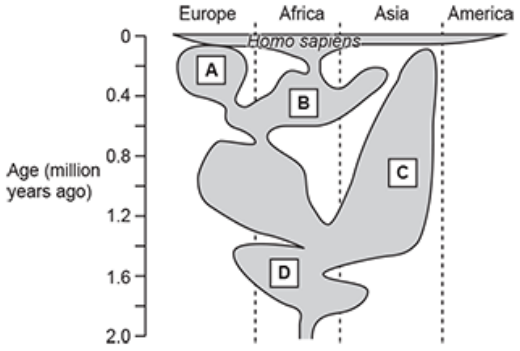
- a very low respiration rate
- haemoglobin that binds to oxygen more easily
- very few pain receptors that respond to acid build up in their body.

Explain how these features would help the mole rats survive in the tunnels.

[6]

5. Studying fossils has provided evidence for the evolution of modern humans (*Homo sapiens*).

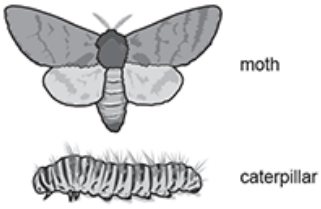
The diagram shows details of four species **A–D** who were modern humans' close relatives.
It shows where fossils were found and dates of when the organisms were alive.



Based on this fossil record, which species would have the most similar DNA to modern humans?

Your answer ☐ **[1]**

6. Pine processionary moths lay eggs that develop into larvae and then into caterpillars, as shown in the diagram.



The caterpillars are a major pest, eating and killing pine trees.

The caterpillars are fed on by birds such as cuckoos. The caterpillars are also parasitised by fungi.

The caterpillars have long hairs on their bodies that cause irritation to predators. Cuckoos have a special sticky membrane lining their guts that traps these hairs. This allows the cuckoos to eat the caterpillars.

Explain how natural selection may have resulted in all cuckoos having the sticky membrane.

[4]

7. Charles Darwin and Alfred Wallace were both involved in the development of the theory of evolution by natural selection.

How were they involved?

A Darwin first suggested the theory and Wallace developed it a hundred years later.
B They both travelled together on a ship called the Beagle.
C They worked together writing a book called 'On the Origin of Species'.
D They wrote scientific papers separately but then presented them together.

Your answer ☐ **[1]**

8. What is phylogenetics?

A Classification using behavioural characteristics
B Classification using evolutionary links
C Classification using physical characteristics
D Classification using species name

Your answer ☐ **[1]**

END OF QUESTION PAPER