

Evolution

1. Giraffes feed on the leaves of trees and other plants in areas of Africa.

Lamarck explained the evolution of the long neck of the giraffe in terms of the animals stretching their necks to eat leaves from tall trees.

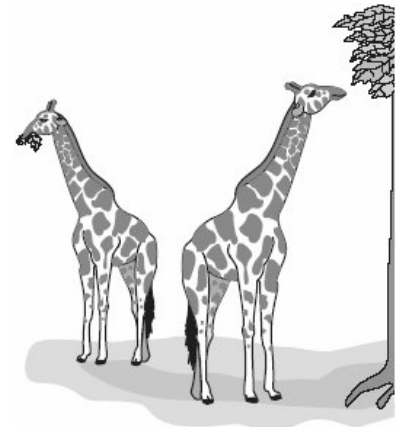
Darwin also explained the evolution of the long neck in terms of getting leaves from tall trees.

Neither scientist used any evidence to support their explanation.

Recently, scientists have tried to explain how the long neck of the giraffe might have evolved.

These are some of their observations.

- Giraffes spend almost all of the dry season, when food is scarce, feeding from low bushes.
- Only in the wet season do they feed from tall trees when new leaves are plentiful.
- Females spend over 50 % of their time feeding with their necks horizontal. Both sexes feed faster and most often with their necks bent.
- Long giraffe necks are very important in male-to-male combat. Males fight each other with their long, powerful necks!
- Female giraffes prefer male giraffes with longer necks.



(a) Do the observations support or reject the explanation that the long neck of the giraffe evolved to get leaves from tall trees? Explain the reasons for your answer.

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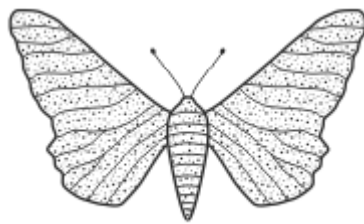
(b) Use the recent observations to give another explanation for the evolution of the long neck of the male giraffe.

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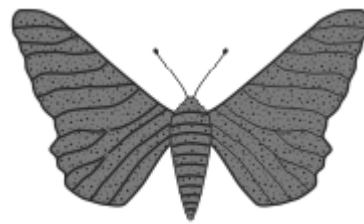
(2)

(Total 4 marks)

2. The drawings show two forms of the peppered moth.



Pale form



Dark form

In an investigation, pale and dark moths were placed in different positions on trees in two woods. One wood was in an industrial area where the bark was blackened by pollution. The other wood was unpolluted, and the tree bark was covered in pale mosses and lichen. After three days, the surviving moths were counted. The results are shown in the table.

WOOD	POSITION OF MOTH ON TREE	PERCENTAGE OF MOTHS EATEN BY BIRDS	
		PALE	DARK
Polluted	On main trunk	58	40
	Underside of branch	50	28
Unpolluted	On main trunk	32	62
	Underside of branch	26	40

(a) What can you tell from these results about the survival of the two types of moth in polluted and unpolluted woods, and in different positions on the tree?

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(b) Explain how the results provide evidence for **one** theory of evolution.

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(Total 6 marks)

3. (a) What does the theory of evolution state?

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(b) *Daphnia* are microscopic water fleas. Midge larvae prey on *Daphnia*. The midge larvae release a hormone into the water. *Daphnia* respond to these hormones by growing larger protective 'helmet'-like structures

Scientists were surprised to observe that the offspring of *Daphnia* females who had been exposed to these hormones always had larger helmets than offspring whose mothers had never been exposed to the hormones. The offspring with the large helmets went on to produce offspring with large helmets.

Explain why the scientists' observations seem to contradict the theory of natural selection.

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(Total 4 marks)

4. Read the extract.

Super-bug may hit the price of coffee

The coffee bean borer, a pest of the coffee crop, can be controlled by the pesticide endosulphan. However, strains of the insect that are up to 100 times more resistant to the pesticide have emerged on the South Pacific island of New Caledonia.

5 For full resistance to be passed on to an offspring two copies of the new resistance allele should be inherited, one from each parent. There is much inbreeding with brother-sister matings happening in every generation, so it takes only a few generations before all the descendants of a single resistant female have inherited two copies of the resistance allele.

10 If this resistance spreads from New Caledonia, it will mean the loss of a major control method. This will present a serious threat to the international coffee industry.

(a) Suggest how the allele for resistance to endosulfan may have arisen.

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(1)

(b) (i) How would you expect the proportion of normal coffee bean borers on New Caledonia to change over the next few years?

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(ii) Explain why this change will take place.

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(c) Explain why “it takes only a few generations before all the descendants of a single resistant female have inherited two copies of the resistance allele.” (lines 6-8)

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(3)

(Total 7 marks)

5. The photograph shows a snake eating a toad.

Cane toads were first introduced into Australia in 1935. The toads contain toxins and most species of Australian snake die after eating the toad.

The cane toad toxin does not affect all snakes the same way. Longer snakes are less affected by toad toxin.

Scientists investigated how red-bellied black snakes had changed in the 70 years since cane toads were introduced into their area. They found that red-bellied black snakes had become longer by around 3 – 5 %.



Suggest an explanation for the change in the body length of the red-bellied black snakes since the introduction of the cane toads.

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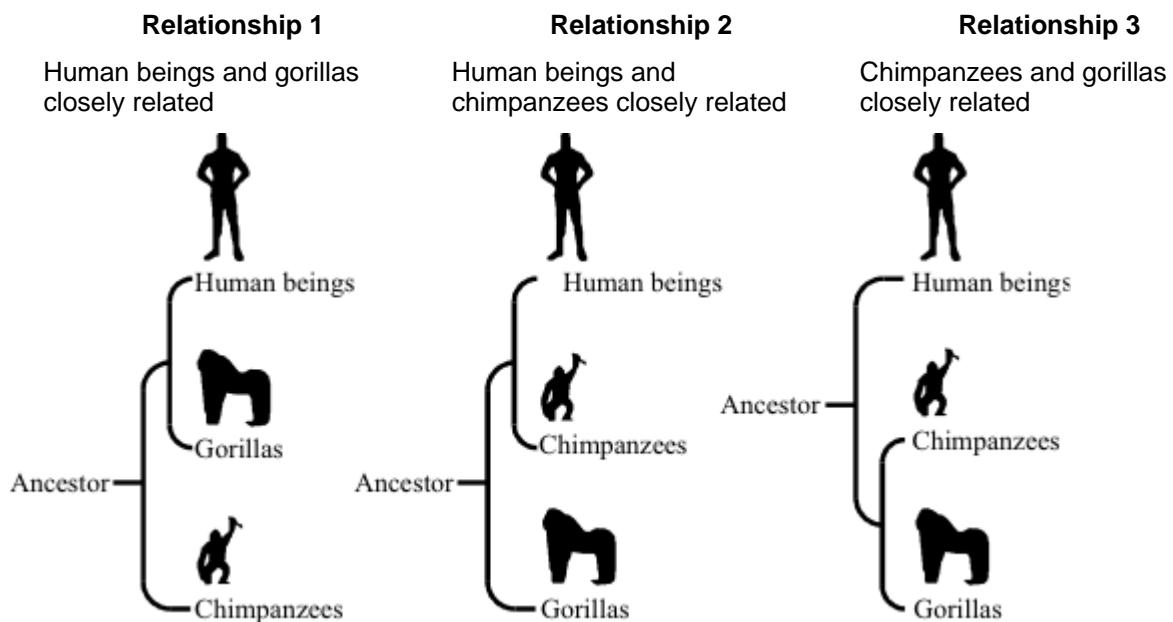
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(Total 4 marks)

6. Biologists believe that human beings, Gorillas and Chimpanzees share a common ancestor. They do not agree as to how this common ancestor evolved into these three species.

The diagram shows three models to represent the evolutionary relationship between the three species and the ancestor.



The table summarises some of the available evidence concerning the relationship between the three species.

Characteristic	Gorillas	Humans	Chimpanzee	Relationship indicated
Bones/teeth				
Limb length	legs shorter than arms	arms shorter than legs	legs shorter than arms	3
canine teeth	large	small	large	3
thumbs	short	long	short	A
Soft parts of body				
head hair	short	long	short	3
buttocks	thin	fat	thin	3
Chromosomes				
total number	B	46	48	3
structure of chromosomes 5 & 12	differs from other primates	like other primates	C	3
fluorescence of chromosome Y & 13	same as Humans	same as Gorilla	same as other primates	1
Molecules				
human haemoglobin	slight difference	not applicable	identical	D

(a) Complete the spaces **A**, **B**, **C** and **D** in the table.

(4)

(b) Much of the evidence for the evolution of humans comes from fossils. Explain why this fossil evidence is often difficult to interpret.

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(Total 6 marks)