



Theories of evolution

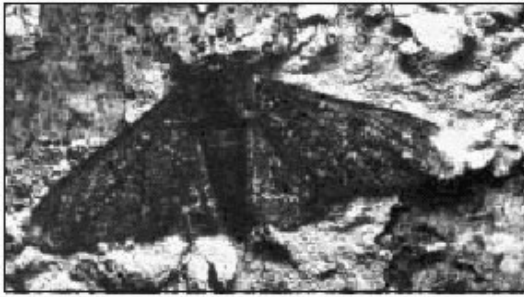


77 minutes

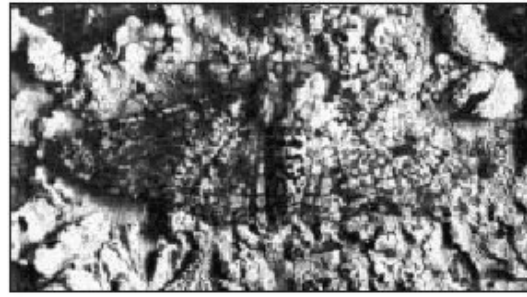


77 marks

Q1. The photographs show two varieties of moths, **X** and **Y**. The moths belong to the same species.
The moths are resting on a tree trunk in open countryside.



Moth X



Moth Y

(a) Which variety of moth, **X** or **Y**, is more likely to be killed by insect-eating birds? Give a reason for your answer.

Variety of moth:

Reason

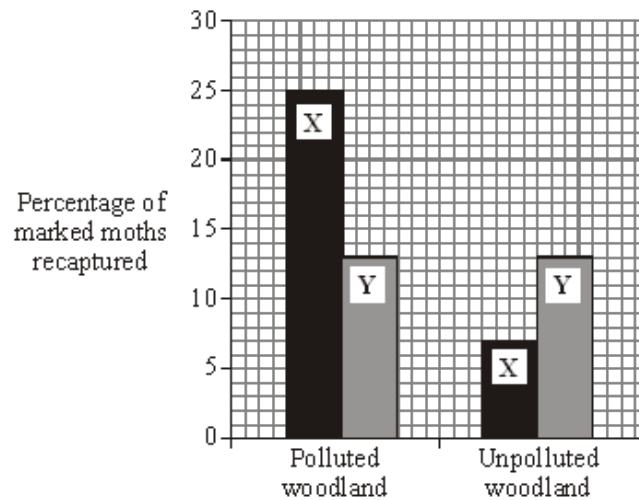
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(1)

(b) In an experiment, large numbers of each variety of moth were caught in a trap.

- They were marked with a spot of paint on the underside of one wing and then released.
- A few days later, moths were again trapped and the number of marked moths was counted.
- The experiment was carried out in a woodland polluted by smoke and soot, and also in an unpolluted woodland.

The results are shown in the bar graph.



(i) When the moths were being marked, suggest why the paint was put on the underside of the wing and not on the top.

.....

(1)

(ii) What percentage of moths of type **X** was recaptured in:

the polluted woodland;

the unpolluted woodland?

(2)

(iii) In each woodland, only a small number of marked moths of both varieties were recaptured. Suggest **one** reason for this.

.....

.....

(1)

(c) (i) The colour of the moths is controlled by a gene. The dark form was first produced by a mutation in the gene.

What chemical, found in a gene, is changed by a mutation? Draw a ring around your answer.

carbohydrate DNA fat protein

(1)

(ii) Some of the offspring from the original dark moth were also dark. What caused this?

.....

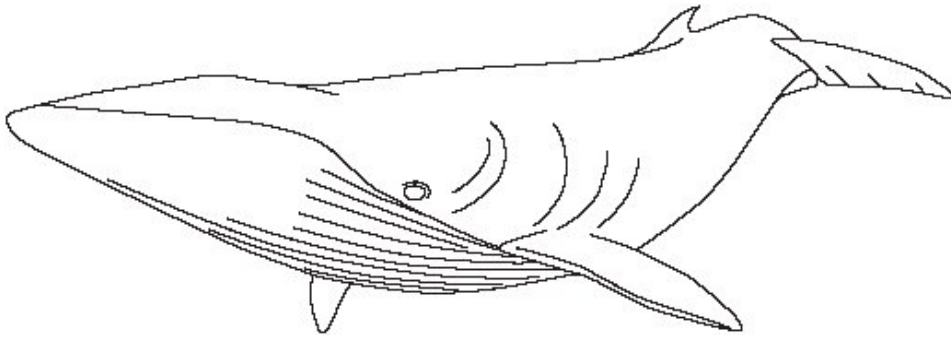
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(1)

(Total 7 marks)

Q2. (a) **Figure 1** shows a minke whale. Whales live in the sea.

Figure 1



Write down **two** ways in which the body of the whale is adapted for swimming.

1

.....

2

.....

(2)

(b) **Figure 2** shows the skeleton of a minke whale.

Figure 2

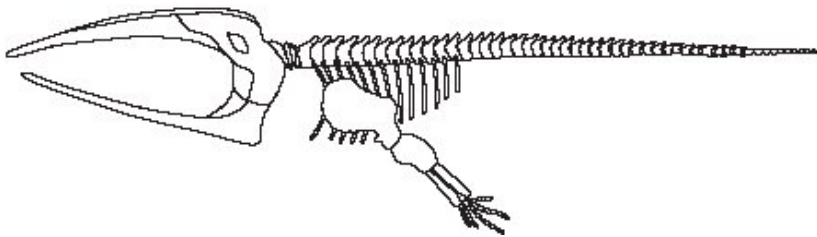
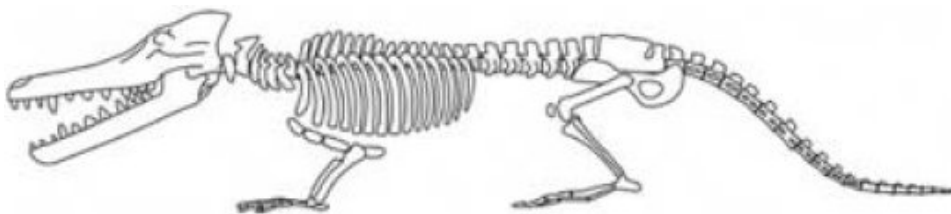


Figure 3 shows the fossil skeleton of an extinct whale.

Figure 3



Hans G Thewissen/ The Thewissen Lab

(i) Apart from size, give **two** differences between the skeleton of the minke whale and the fossil skeleton of the extinct whale.

1

.....

2

.....

(2)

(ii) In each of the sentences below, draw a ring around the correct answer.

Life on Earth first developed more than three

billion
million
thousand

 years ago.

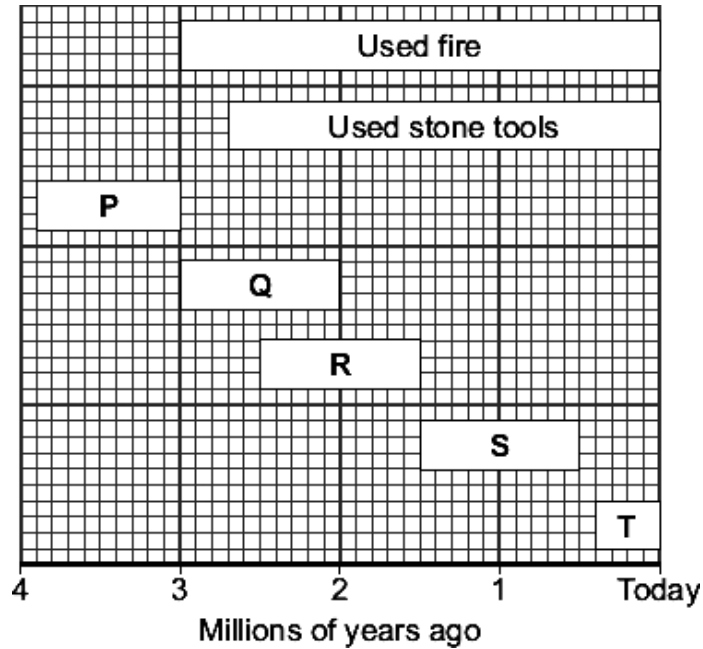
Fossils

disprove
give evidence for
prove

 the theory of evolution.

(2)
(Total 6 marks)

Q3. The diagram shows a time line for the evolution of humans.



The letters **P**, **Q**, **R** and **S** show human ancestors.
The letter **T** shows modern humans.

(a) (i) How many millions of years ago did humans first use fire? millions of years ago

(1)

(ii) Which human ancestor, **P**, **Q**, **R** or **S**, was the first ancestor to use tools?

(1)

(iii) For how many millions of years did human ancestor **R** live on Earth?

(1)

(b) How do we know that human ancestors **P**, **Q**, **R** and **S** lived on Earth?

.....
.....

(1)

(c) Which scientist suggested that humans have evolved from ape-like ancestors?

Draw a ring around **one** answer.

Darwin

Mendel

Semmelweiss

(1)
(Total 5 marks)

Q4. The diagram shows an evolutionary tree for a group of animals called primates.

The names of extinct animals are printed in italics e.g. *Nycticeboides*.

The drawings show animals that are alive today.

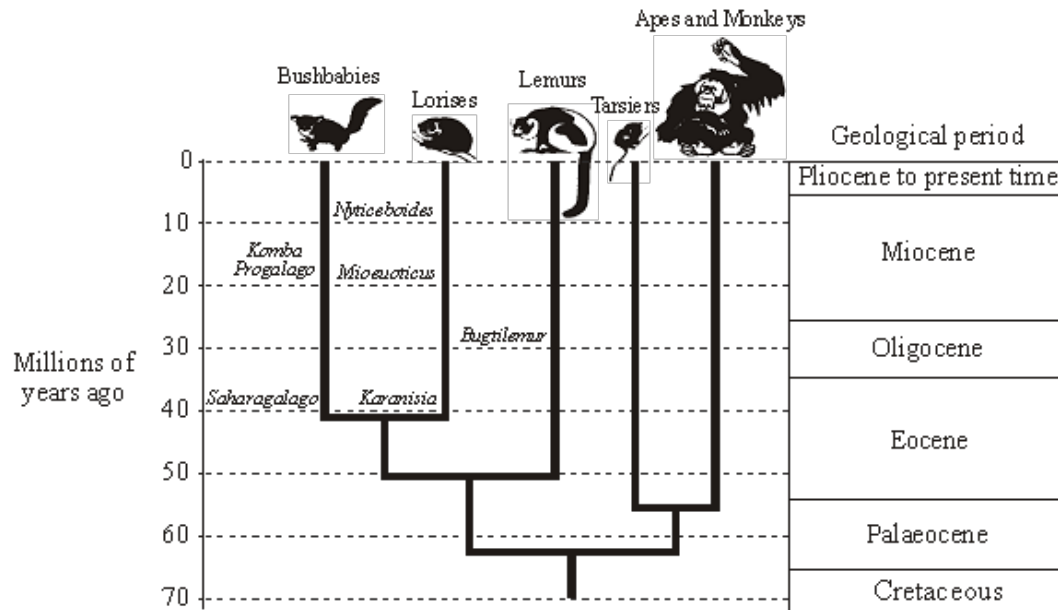


Illustration by Lucrezia Beerli-Bieler

(a) (i) How many million years ago did *Karanisia* first appear?

..... millions of years ago.

(1)

(ii) During which geological period did the Apes and Monkeys begin to evolve?

.....

(1)

(iii) Which group of primates alive today are the closest relatives of the Lorises?

.....

(1)

- (b) Darwin was the first scientist to state that humans and other primates had common ancestors.

Many people were against Darwin's ideas at that time.

Give **two** reasons why they were against his ideas.

1

.....

2

.....

(2)
(Total 5 marks)

Q5. The theory of evolution via natural selection was proposed by Darwin.

- (a) Explain how evolution occurs via natural selection.

.....

.....

.....

.....

.....

.....

.....

.....

(4)

- (b) Darwin's theory was only gradually accepted.

Give **two** reasons why.

1

.....

2

.....

(2)
(Total 6 marks)

Q6. 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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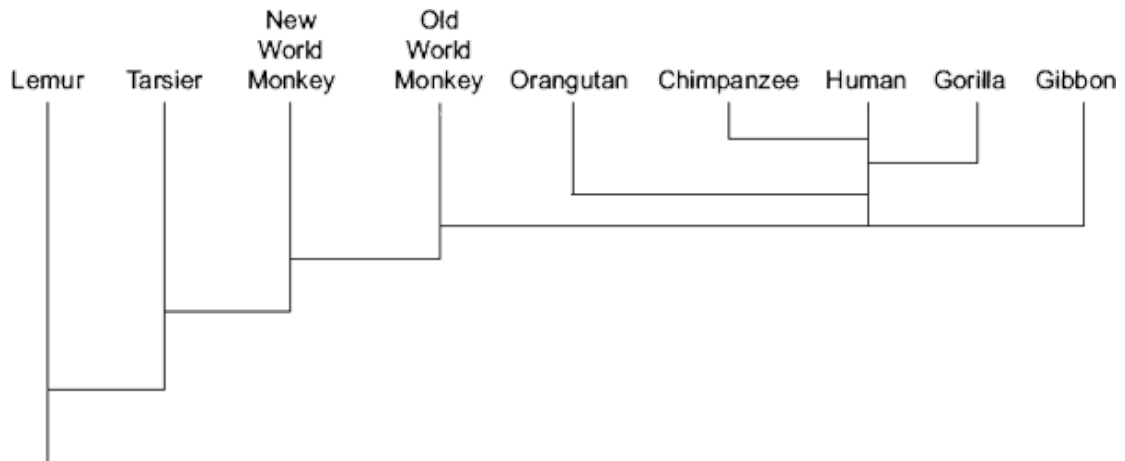
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.....

.....

(Total 4 marks)

Q7. The diagram shows the evolution of a group called the primates.



(a) Which primate evolved first?

.....

(1)

(b) Name **two** primates that developed most recently from the same common ancestor as humans.

1

2

(2)

(c) (i) The theory of evolution by natural selection was suggested in the 1800s.

Which scientist suggested this theory?

.....

(1)

(ii) Use words from the box to complete the passage about natural selection.

evolution	environment	generation
mutate	survive	variation

Individual organisms of a species may show a wide range of because of differences in their genes.
Individuals with characteristics most suited to the
are more likely to and breed successfully.
The genes that have helped these individuals to survive are then passed on to the
next

(4)
(Total 8 marks)

Q8. Charles Darwin proposed the theory of natural selection.

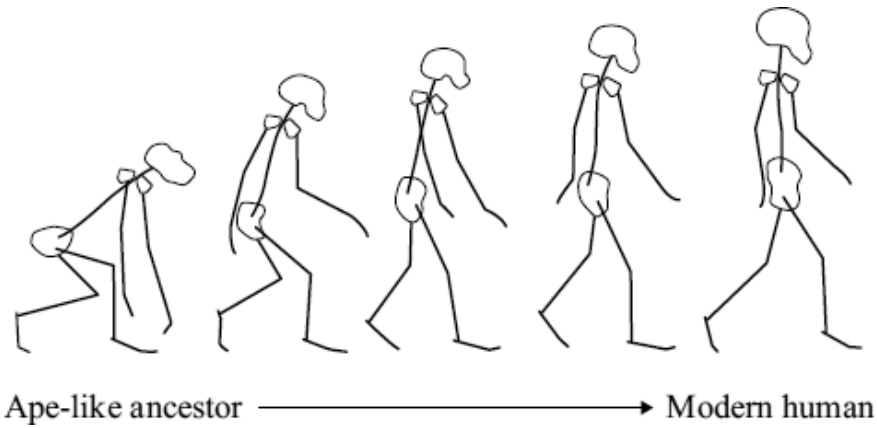
(a) What is meant by natural selection?

.....
.....
.....
.....

(2)

(b) The drawings show stages in the evolution of the human skeleton.

All the drawings are to the same scale.



Use information from the drawings to describe **two** trends in the evolution of the human skeleton.

- 1
-
- 2
-

(2)

(c) Darwin said that humans had evolved from ape-like ancestors.

Many people disagreed with him at the time.

Give **two** reasons why.

- 1
-
- 2
-

(2)

(d) Lamarck's theory of evolution stated that useful changes which occur in an organism during its lifetime will be inherited by its offspring.

Give **one** way in which Darwin's theory differs from Lamarck's.

-
-

(1)

(Total 7 marks)

Q9. The vole is a small, mouse-like animal. Voles found on some cold islands to the north of Scotland are much larger than voles found in warmer areas such as southern France. Explain how natural selection may have caused the northern voles to be larger in size.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total 5 marks)

Q10. (a) Complete the sentences about evolution.

Draw a ring around the correct answer to complete each sentence.

(i) Darwin suggested the theory of evolution by

artificial
natural
asexual

 selection.

(1)

(ii) Darwin's theory of evolution says that all species of living things have

evolved from

artificial
complex
simple

 life forms.

(1)

(iii) Most scientists believe that life first developed about

three billion
three million
three thousand

 years ago.

(1)

(b) Darwin's theory of evolution was only slowly accepted by other people.

Give **two** reasons why.

1.....

.....

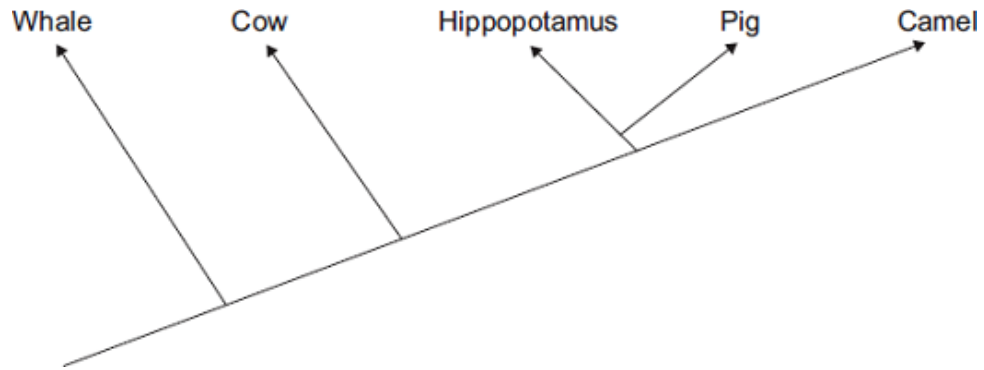
2.....

.....

(2)

(c) **Diagram 1** shows one model of the relationship between some animals.

Diagram 1



(i) Complete the sentence.

The model shown in **Diagram 1** is an evolutionary

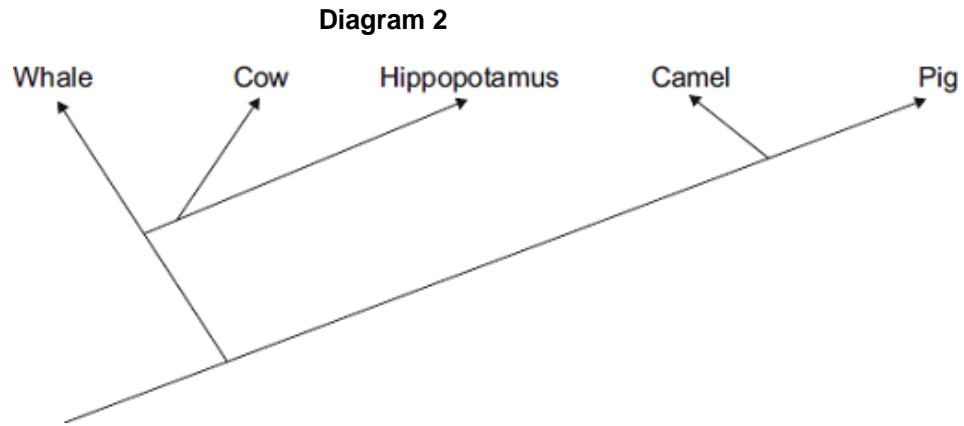
(1)

(ii) Which **two** of the animals in **Diagram 1** are most closely related?

..... and

(1)

(iii) Diagram 2 shows a more recent model of the relationship between the animals.



Suggest **one** reason why scientists have changed the model of the relationships between the animals shown in the diagram.

Draw a ring around the correct answer.

more powerful computers

new evidence from fossils

new species discovered

(1)
(Total 8 marks)

Q11. Darwin was the first scientist to state that humans and other primates had common ancestors.

Many people were against Darwin's ideas at that time.

Give **two** reasons why they were against his ideas.

1

.....

2

.....

(Total 2 marks)

Q12. The drawings show two forms of the peppered moth.



Pale form
Pale form



Dark 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?

.....

.....

.....

.....

.....

.....

(3)

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

.....

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.....

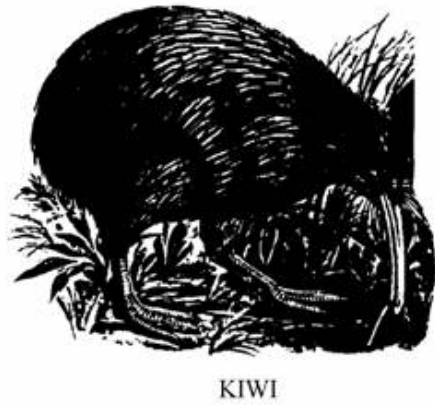
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(3)

(Total 6 marks)

##

Many islands in the Indian and Pacific oceans have or used to have large flightless birds like the dodo on Mauritius and the kiwi on New Zealand.



- * Scientists think that birds on these islands came from elsewhere.
- * Birds were able to fly to the islands.
- * Birds living on islands may get blown out to sea and drown.
- * Flying uses up lots of energy.
- * Large birds find it difficult to fly.
- * Islands in the middle of oceans had no mammal predators.

(a) Use this information to suggest how flightless birds evolved on different islands.

.....
.....
.....
.....
.....
.....
.....

(6)

(b) This evolution of the kiwi could not have occurred unless there was some variation between the birds.

Suggest **two** factors which could produce this range of variation.

1
.....
2
.....

(2)

(Total 8 marks)

- M1.** (a) **X** (no mark)
- X** is more visible **or** **Y** is more camouflaged 1
- (b) (i) so camouflage not changed **or** so not easier to see 1
- (ii) 25 1
- 7 1
- (iii) any **one** from:
- eaten (by birds) / died
 - mixed in with large number of unmarked moths
 - moved away
- 1
- (c) (i) DNA 1
- (ii) the gene / allele for being dark / dominant 1

[7]

- M2.** (a) any **two** from:
- streamlined / shape reduces friction / long and thin / smooth surface
OWTTE
 - fins / flippers / tail / paddle
*do **not** accept 'arms' or 'legs'*
 - structures that push against water
- 2

- (b) (i) any **two** from:
- fossil has hind limb / legs / feet
it = minke
accept any valid comparison
 - fossil has more ribs / bones
 - fossil has teeth
 - fossil has curved spine
- 2
- (ii) billion
- 1
- give evidence for
- 1
- [6]**

- M3.** (a) (i) 3
- 1
- (ii) Q
- 1
- (iii) 1
- 1
- (b) from fossils / bones
allow artefacts / named artefacts / drawings / evidence of fires
- 1
- (c) Darwin
- 1
- [5]**

- M4.** (a) (i) 40 – 42
- 1
- (ii) Palaeocene
- 1
- (iii) bush babies
- 1

(b) any **two** from:

- religious objections
- insufficient evidence
allow 'could not prove'
ignore 'no evidence'
- mechanism of heredity not known

2

[5]

M5. (a) organisms within species may show variation

1

because mutation(s) occur in individuals

1

this results in the individuals with characteristics most suited to the environment being more likely to survive / to breed

1

as a consequence the genes that have enabled these individuals to survive are passed on to the next generation

1

(b) any **two** from

- the theory undermined the idea that God made all the animals and plants that live on earth
- there was insufficient evidence at the time
- the mechanism of inheritance / variation was not yet known

2

[6]

M6. any **four** from

- mutation
*do **not** accept 'had to mutate / decided to mutate'*
- produces longer snake **or** there is variation in snake length
*do **not** accept 'had to adapt and became longer'*
- longer snake less susceptible to toxin **or** longer snake survives
- survivors reproduce
- gene passed to next generation
allow characteristic passed to next generation

[4]

M7. (a) lemur(s)

1

(b) gorilla(s)

in either order

1

chimpanzee(s)

accept chimps

1

(c) (i) (Charles) Darwin

accept (Alfred) Wallace

if first name given it must be correct

1

(ii) variation

in this order

1

environment

allow phonetic spellings

1

survive

1

generation

1

[8]

M8. (a) any **two** from:

- survival of fittest
allow examples
- amplification of fittest ie has adaptations to survive
allow examples
- go on to breed **or** genes / characteristics passed on to next generation
NB best adapted organisms survive gains 2 marks

2

(b) any **two** from eg:

ignore unqualified change eg 'the skull changes shape'

- increased height
- increased erectness
allow description of modern human characteristic eg 'modern humans stand up straight'
- shorter arms
- legs straighter
- larger skull
allow description of ape-like characteristics eg ape-like ancestor walked on four legs
- larger pelvis **or** changing shape described
- humans walk on two legs / feet

2

(c) any **two** from:

- religious objections
- insufficient evidence
*ignore **no** evidence*
accept could not prove
- mechanism of heredity not known
did not know about genes /chromosomes / DNA / mutations
- did not like the thought of being descended from apes

2

(d) Darwin's theory depends on differences in genes at birth / inborn variation / mutation

allow Darwin's theory depends on genetics

ignore reference to time

1

[7]

M9. any **five** from:

- genetic variation exists in a population **or** variation caused by mutation / change in gene / in DNA
- larger voles have smaller $\frac{S.A.}{Vol.}$ **or** have more fat
'they' accept as larger voles
- larger voles lose less heat / are better insulated **or** more energy stored
- larger voles survive
- larger voles breed
- larger voles pass on (beneficial) gene / allele / mutation / DNA
ignore characteristic

[5]

M10. (a) (i) natural

1

(ii) simple

1

(iii) three billion

1

(b) any **two** from:

- reference to religion
- insufficient evidence / couldn't prove it / no proof
ignore no evidence
- mechanism of inheritance / variation not known
allow genes / DNA not known about
- reference to other theories
- reference to Darwin's status

2

(c) (i) tree

1

(ii) hippopotamus **and** pig
both required, either order
allow hippo

1

(iii) new evidence from fossils

1

M11. any **two** from:

- religious objections
- insufficient evidence
allow 'could not prove'
ignore 'no evidence'
- mechanism of heredity not known

[2]

M12. (a) greater proportion of dark moths survive in polluted woods
Greater proportion of pale moths survive in unpolluted woods
% survival on underside of branch is greater in both situations
each for 1 mark

3

- (b) *ideas that (please indicate in body of answer by √1, √2, √3)*
1. different sorts of moths / pale and dark moths
 2. ideal of differential survival in different habitats
 3. this is evidence for natural selection / survival of the fittest
or idea that feature likely to be passed on
- each for 1 mark*

3

[6]

M13. (a) *ideas that*

- birds reached islands by flying
- some variation between these birds
- flight not needed to escape predators
- flight uses energy
- flight could result in death by drowning
- so non-flying birds favoured by natural selection
or better chance to survive and breed
- so larger birds at an advantage
- any six for 1 mark each

6

(b) *idea*

- large number of genes per characteristic
- large range of alleles/large gene pool

(credit for these points not to be given if they are made in (a))

- mutation(s)

(credit idea of inheritance and environment as the two factors with 1 mark)
any two for 1 mark each

2

[8]

