Unit 4 Biology

Revision Booklet 14

Topics

Hominin Evolution

Name: .....

Question 8

In 2008, two incomplete, fossilised skeletons were found in cave deposits in South Africa. The scientists compared the newly discovered bones with those of members of the genus *Australopithecus*, early *Homo*, modern humans and apes. The fossilised skeletons, named *Australopithecus sediba*, displayed an unusual mix of characteristics. They partly resembled primitive, ape-like animals.

Like the apes, *A. sediba* was of small stature. Scientists determined that *A. sediba*, like apes, was suited to climbing in trees.

a. What feature of the *A. sediba* skeleton allowed scientists to reach this conclusion?

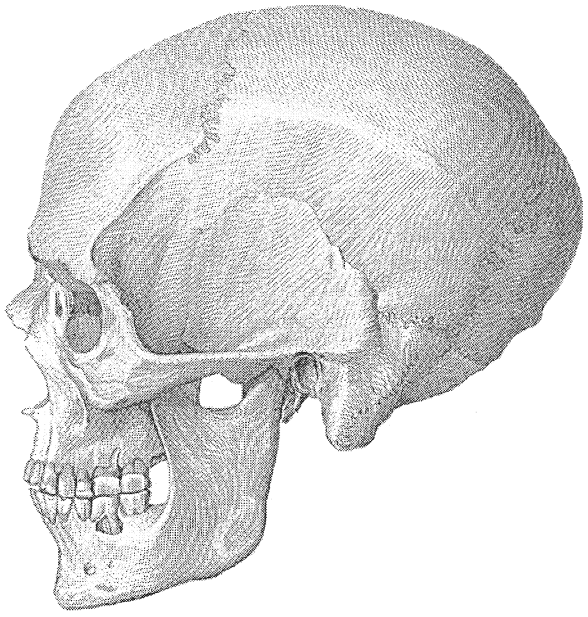
1 mark

A. sediba was found to have many characteristics in common both with the members of the genus *Australopithecus* and with the genus *Homo*. Two characteristics shared with the genus *Homo* included a projecting nose and hands with a precision grip.

b. Explain how each of these characteristics may have given *A. sediba* an advantage over other *Australopithecus* species.

2 marks

Below is a drawing of the skull of a modern-day human.



c. Using the drawing, suggest one feature of modern-day humans that makes humans more advanced than other *Homo* species. Explain the significance of this feature to the evolution of modern humans.

2 marks

Fossil evidence from South Africa has shown that early humans (approximately 77 000 years ago) constructed sleeping mats from local plants. Later evidence from approximately 73 000 years ago indicates that the bedding was burnt on a regular basis.

d. Suggest the cultural and/or technological significance of each of these findings.

2 marks

END OF QUESTION AND ANSWER BOOK

Question 7

The Mitochondrial Eve Hypothesis suggests that the mitochondrial DNA of all living people can be traced back to a few women in Africa.

a. **i.** Why is mitochondrial DNA useful for tracking human evolutionary history?

_____

_____

ii. Name another type of DNA that can be used to trace human ancestry.

_____

_____

1 + 1 = 2 marks

It has been observed that

- samples of mitochondrial DNA taken from living humans are very similar to each other
- the greatest variation of mitochondrial DNA is observed within African populations.

b. Based on these observations, what are **two** inferences that can be made about human evolution?

_____

_____

_____

_____

2 marks

c. **i.** Explain why DNA analysis cannot be used to trace very early hominin (previously called hominid) ancestry.

_____

_____

ii. Outline two types of evidence, other than DNA analysis, that can be used to determine the relatedness and age of early hominins.

Evidence 1

_____

_____

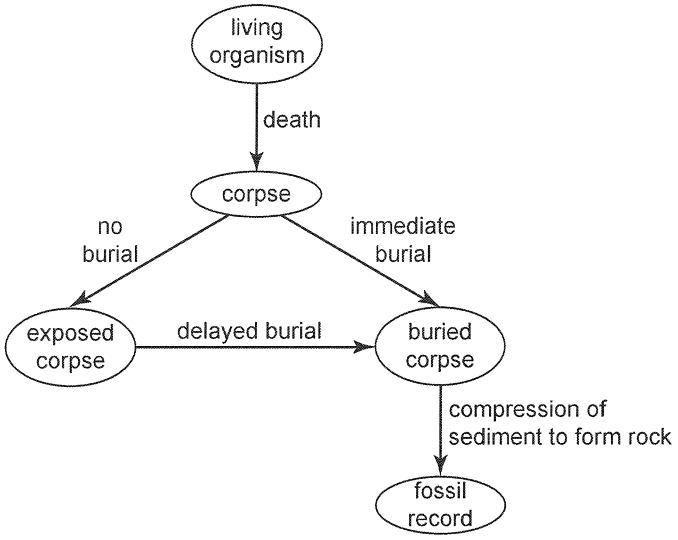
Evidence 2

_____

_____

1 + 2 = 3 marks

Two early hominins were fossilised in two different areas of Africa. One hominin was buried quickly during an avalanche while the other was buried slowly on a forest floor. The figure below represents these two different possibilities for fossilisation of the hominins.



d. **i.** Outline one reason why the hominin in the forest would have a greater chance of being only partially fossilised.

_____

_____

ii. State one factor not indicated on the diagram that would increase the chance of fossilisation of an organism.

_____

_____

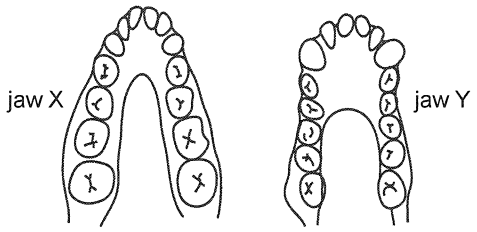
1 + 1 = 2 marks

Total 9 marks

END OF QUESTION AND ANSWER BOOK

Question 5

The following diagram shows two lower jaws, one from Australopithecus and the other from a gorilla (*Gorilla gorilla*).



a. Outline the differences between two characteristics, other than tooth number, that enable you to distinguish which jaw is that of Australopithecus.

Difference 1 _____

_____

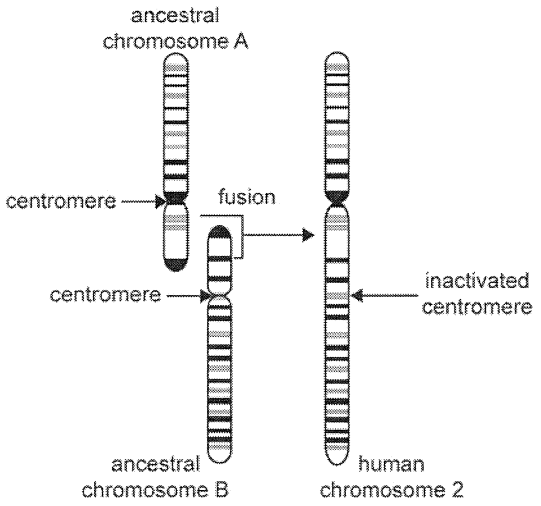
Difference 2 _____

_____

2 marks

Molecular techniques allow detailed examinations of DNA sequences of chromosomes and the rearrangements that have taken place during evolution.

Two chromosomes of the last common ancestor that humans had with chimpanzees fused and gave rise to human chromosome number 2. This fusion is represented in the following diagram.



After fusion of the chromosomes, one of the centromeres from the fused chromosomes was inactivated.

b. Why was the inactivation of one of the centromeres a significant step in human evolution?

_____

_____

_____

_____

2 marks

Total 4 marks

Question 6

The press recently reported:

'Anthropologists have uncovered ancient fossil footprints in Kenya dating back 1.5 million years, the oldest evidence that indicates our ancestors walked like present-day humans . . .'

a. Give one significant feature of the footprints that would have led anthropologists to this conclusion.

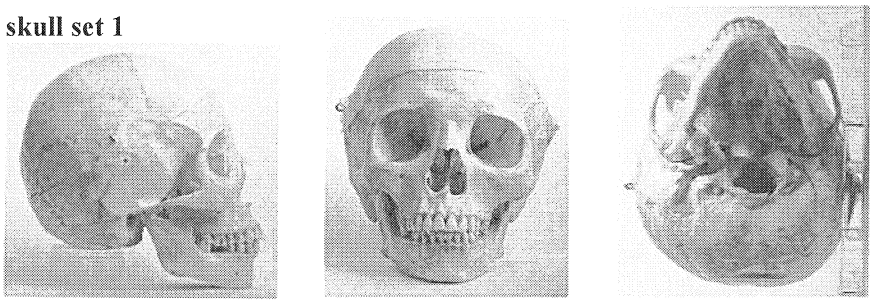
_____

_____

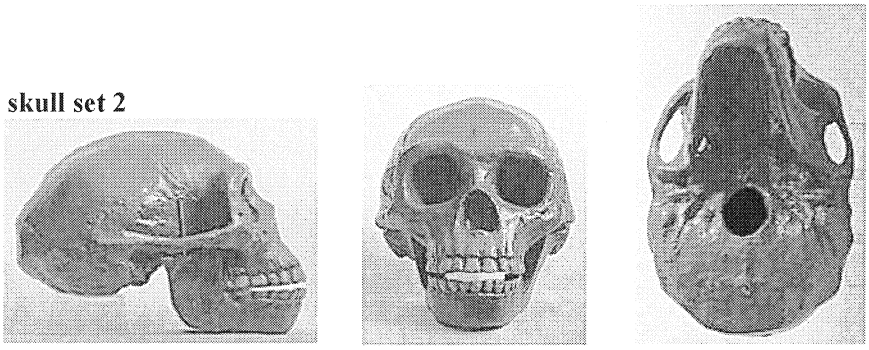
1 mark

The pictures below show views of skulls from *Homo erectus* and *Homo sapiens*.

skull set 1



skull set 2



b. With reference to two structural features of the skull, which skull set represents *Homo erectus*? Justify your choice.

Skull set _____

Justification_____

_____

_____

_____

_____

_____

2 marks

According to one interpretation of the hominid fossil record, *Homo habilis* is thought to have existed about 2 million years ago.

c. What kind of discoveries have been made at *Homo habilis* sites that have increased our understanding of the technological evolution of hominids?

_____

_____

1 mark

'The rate of technological evolution has been increased by cultural evolution of *Homo sapiens*.'

d. **i.** Describe one example of the effect that cultural evolution has had on the rate of technological evolution.

_____

_____

_____

Cultural evolution depended on the development of physical capabilities of the Homo genus.

ii. What physical feature has played the most important role in this advancement?
How has this feature developed over evolutionary time?

Feature _____

Development _____

_____

_____

Arguably, modern *Homo sapiens* has taken the manipulation and control of the environment to its highest level in history.

iii. Does this mean that our species will no longer physically evolve by the mechanism of natural selection? Justify your answer.

_____

_____

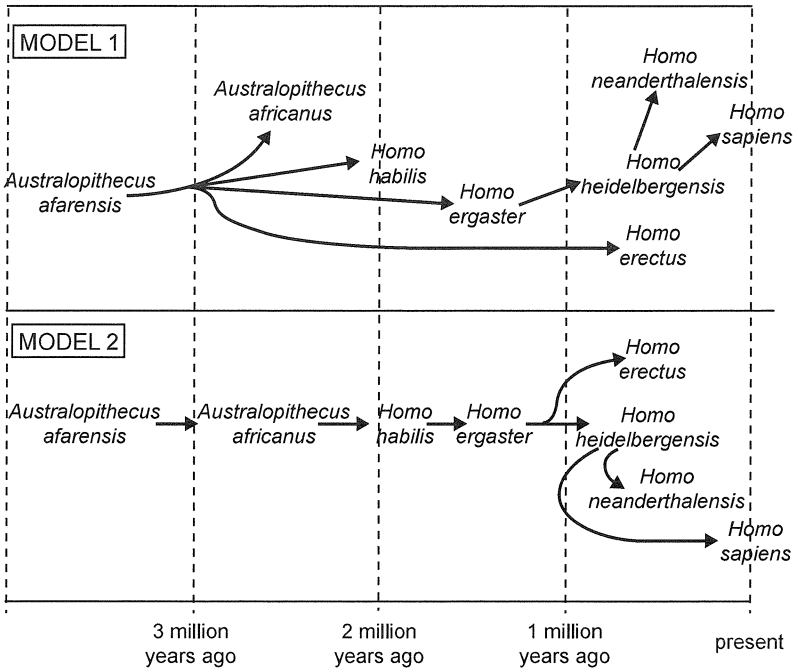
_____

1 + 1 + 1 = 3 marks

Total 7 marks

Question 8

Two paleoanthropologists each used fossil data to draw a model of the human evolutionary tree. The two models they produced are shown below.



a. Explain how it is possible that the paleoanthropologists produced different models for the human evolutionary tree.

_____

_____

1 mark

b. **i.** State one feature of agreement between the models.

_____

ii. State one feature of conflict between the models.

_____

1 + 1 = 2 marks

c. Give **two** structural features that would distinguish between the fossils of *Homo erectus* and *Australopithecus afarensis*.

_____

_____

2 marks

Evidence suggests that *Homo sapiens* and *Homo neanderthalensis* were living in the same areas some 30 000 years ago, but did not interbreed.

d. Give one reason why interbreeding might not have occurred.

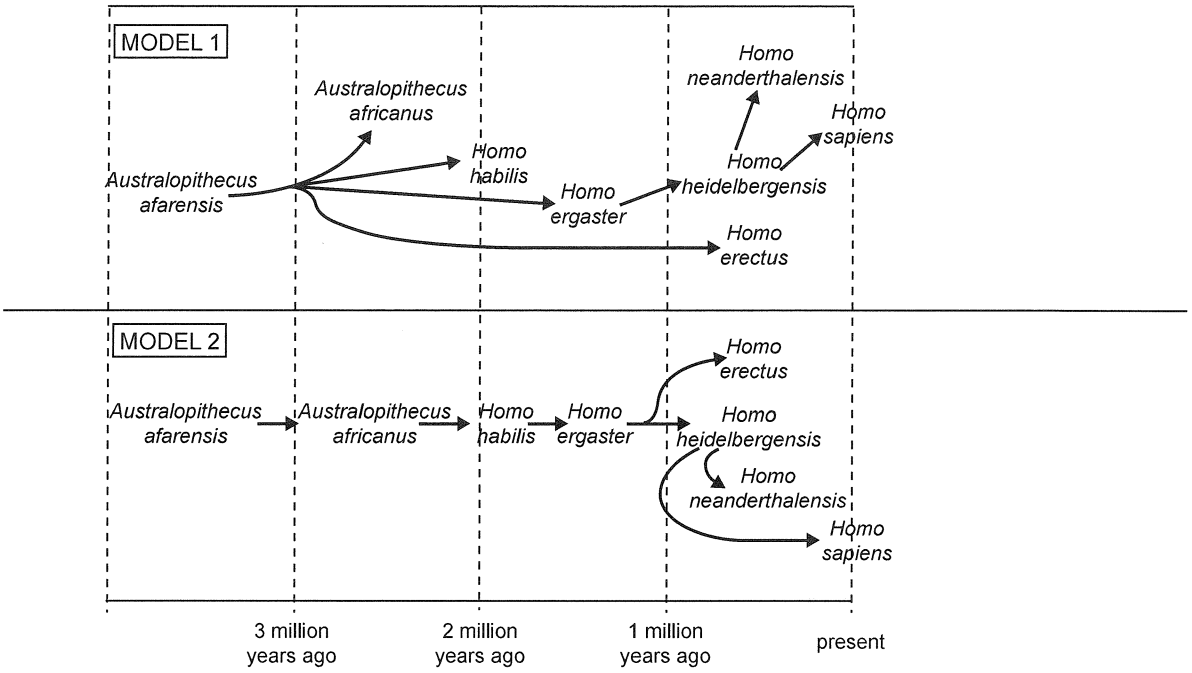
_____

_____

1 mark

Scientists have recently discovered a tiny fossil skull in Indonesia. It has been named *Homo floresiensis* (the hobbit) and dated to the time our own ancestors were colonising the world. Some scientists believe *Homo floresiensis* evolved from *Homo erectus*. Fossils of *Homo erectus* have also been discovered in Indonesia.

e. Modify **one** of the models below to include *Homo floresiensis*.



1 mark

There is still some debate about what the hobbit is. Two explanations have been proposed.

Explanation 1 – The hobbit belongs to a species of small-brained dwarf humans.

Explanation 2 – The hobbit is a Stone Age *Homo sapiens* with a disease that stunts brain development.

f. **i.** Suggest one piece of evidence that would support explanation 1.

_____

_____

_____

ii. Suggest one piece of evidence that would support explanation 2.

_____

_____

_____

1 + 1 = 2 marks

Total 9 marks

END OF QUESTION AND ANSWER BOOK

Question 8

a. Outline the main steps involved in the process of speciation.

3 marks

In October 2004, on the remote Indonesian island of Flores, archaeologists discovered bones from a new species of human called *Homo floresiensis*. These humans were much smaller than modern humans, with adults being about 1 metre in height and weighing around 25 kilograms. Bones from six or seven individuals have been discovered in sediments ranging in age from 94 000 to 13 000 years. The skeletons indicate that these humans had relatively long arms and a very small brain relative to body size, about equivalent to that of a chimpanzee. They had hard, thick eyebrow ridges and a sharply sloping forehead and no chin. Modern humans, *Homo sapiens*, are thought to have evolved somewhere between 55 000 and 35 000 years ago.

b. It has been suggested that *Homo floresiensis* evolved from a population of *Homo erectus*. List two features from the fossil remains that support this view.

Feature 1 _____

Feature 2 _____

2 marks

c. Suggest a method by which the ages of the bones of *Homo floresiensis* were estimated if found in sediments 13 000 years old.

1 mark

d. Stone tools were found in the same sediments as the *Homo floresiensis* bones. This is an example of cultural evolution. From your studies in Biology, describe another example of cultural evolution in human populations.

_____

_____

_____

_____

1 mark

Total 7 marks

Question 9

Mammals are considered to have been extremely successful in evolutionary terms. One reason for this may be their well-developed sense of hearing.

a. Suggest one reason why a well-developed sense of hearing would contribute to the evolutionary success of mammals.

_____

_____

_____

_____

1 mark

This well-developed sense of hearing is partly due to three tiny bones in the middle ear.

Scientists believed that the middle ear probably developed from small bones in the jaw of an early mammal. This early mammal then evolved into the three modern mammalian groups: monotremes (the platypus and echidna), marsupials (such as kangaroos) and placental mammals (such as humans, mice, gorillas).

b. What term describes the evolution of the three mammalian groups from the early mammal?

_____

1 mark

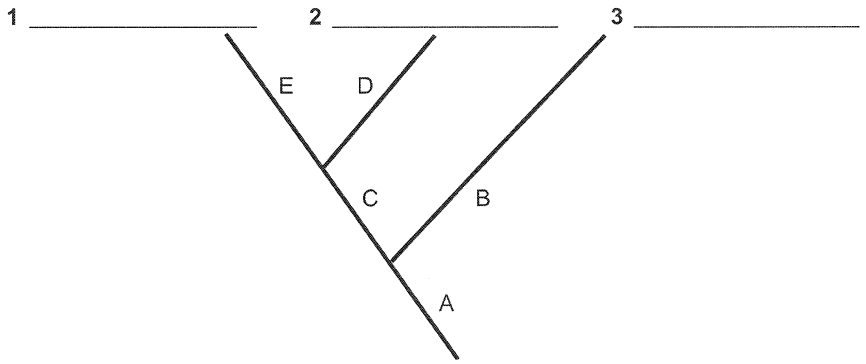
In February 2005 scientists reported the discovery of a jawbone from *Teinolophos trusleri* that lived 115 million years ago and is thought to be the world's oldest known monotreme. It is believed that by 115 million years ago the monotremes had split off on their own evolutionary line from marsupial and placental mammals. This jawbone provides evidence that the transformation of the small bones from the jaw into the middle ear occurred independently in the two main evolutionary lines of living mammals. This supports the view that today's monotremes are a different branch of the mammalian family tree from the marsupial and placental mammals.

c. What type of evolution describes the formation of the middle ear bones in the two mammalian lines?

_____

1 mark

d. In the spaces alongside 1, 2 and 3 show the possible evolutionary relationships between placental mammals, marsupials and monotremes suggested by this discovery.



1 mark

e. Based on this discovery in *Teinolophos trusleri*, along which branches (A, B, C, D and E) in the above diagram could the lower jawbone have evolved into the middle ear?

_____

2 marks

Total 6 marks

END OF QUESTION AND ANSWER BOOK