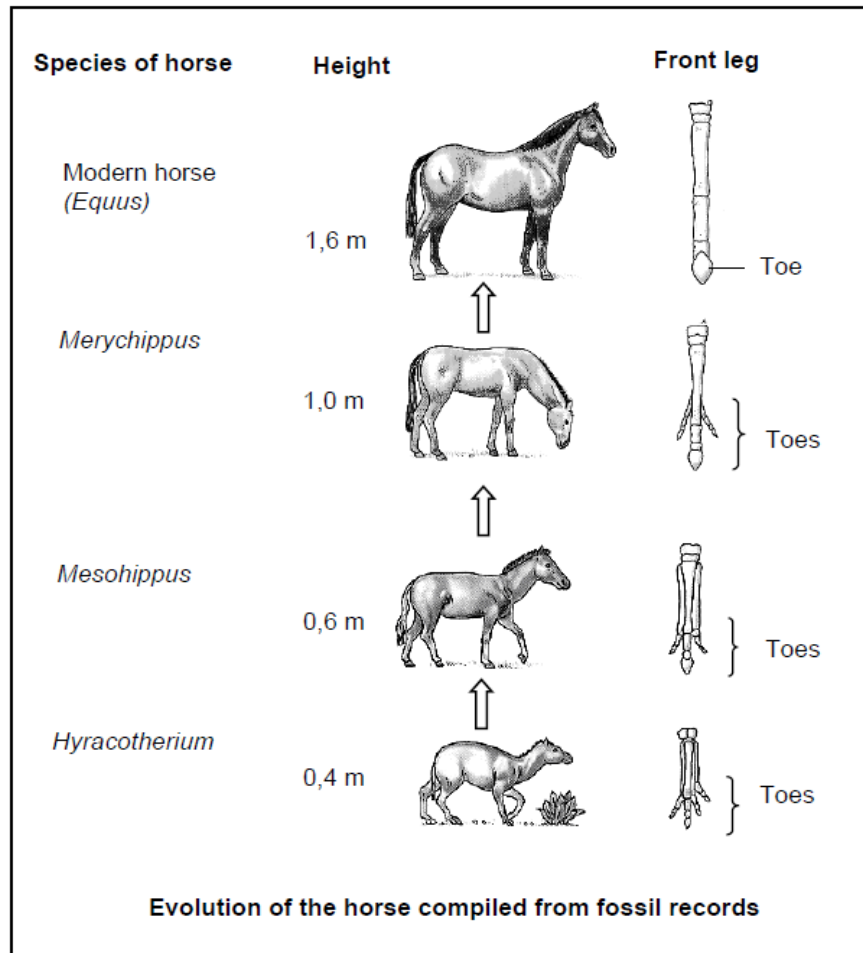


EVOLUTION

Paper 2: 66 marks

1. Evidence for Evolution

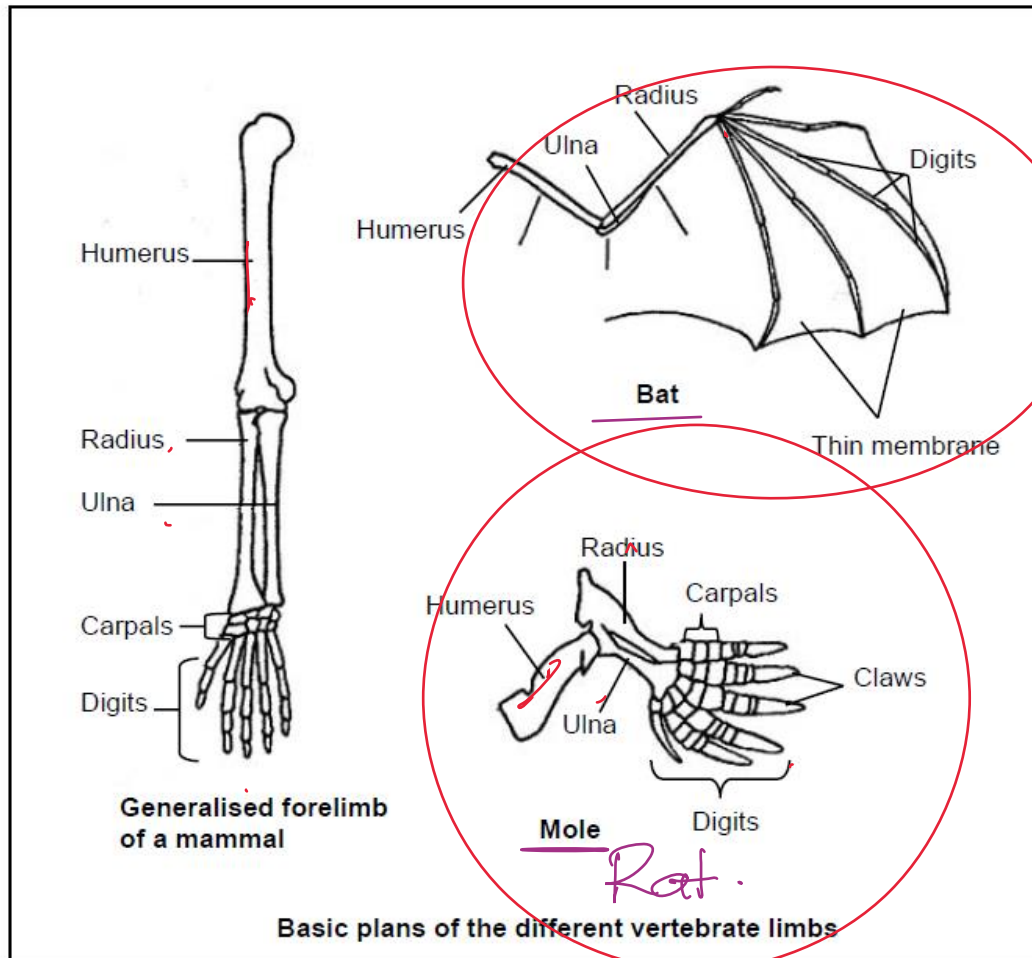
- 2.2 The diagrams below represent the evolution of the horse, compiled from fossil records.



- 2.2.1 How many times is the modern horse taller than its earliest ancestor? Show your working. (3)
- 2.2.2 What happened to the appearance of the feet of the horse over time? (2)
- 2.2.3 Palaeontologists suggest that ancient horses lived in forests, but modern horses live in open grassland. Explain ONE way in which the modern horse is adapted to open grassland. (2)

ADAPTED BY MR S.J SILAULE

3.4 Study the basic plans of three different vertebrate limbs shown below.



3.4.1 Are the above examples of homologous or analogous structures? (1)

3.4.2 Explain your answer to QUESTION 3.4.1. (2)

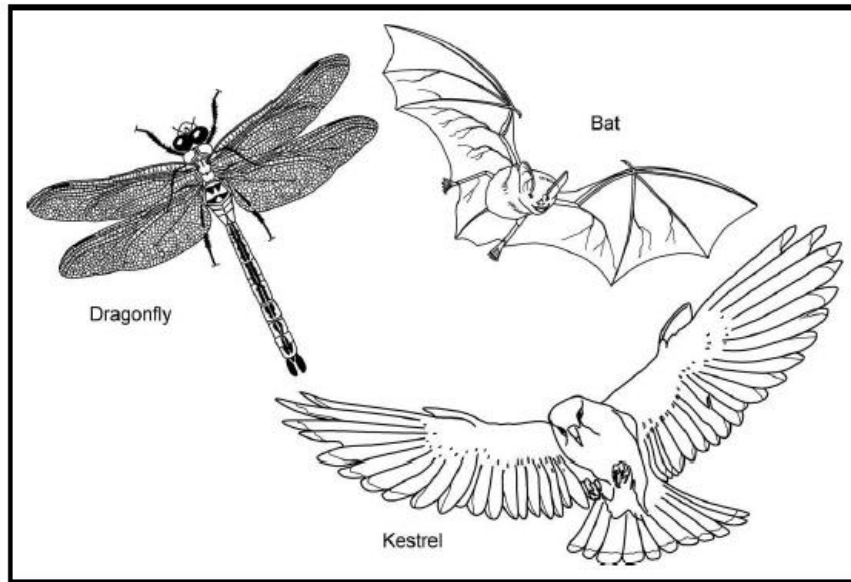
3.4.3 State ONE way in which the forelimbs of the:

- (a) Bat are adapted for flying (1)
 (b) Mole are adapted for digging holes (1)

*Smaller structures ✓
 but different functions ✓*

ADAPTED BY MR S.J SILAULE

3.2 Study the diagram below and answer the questions that follow:

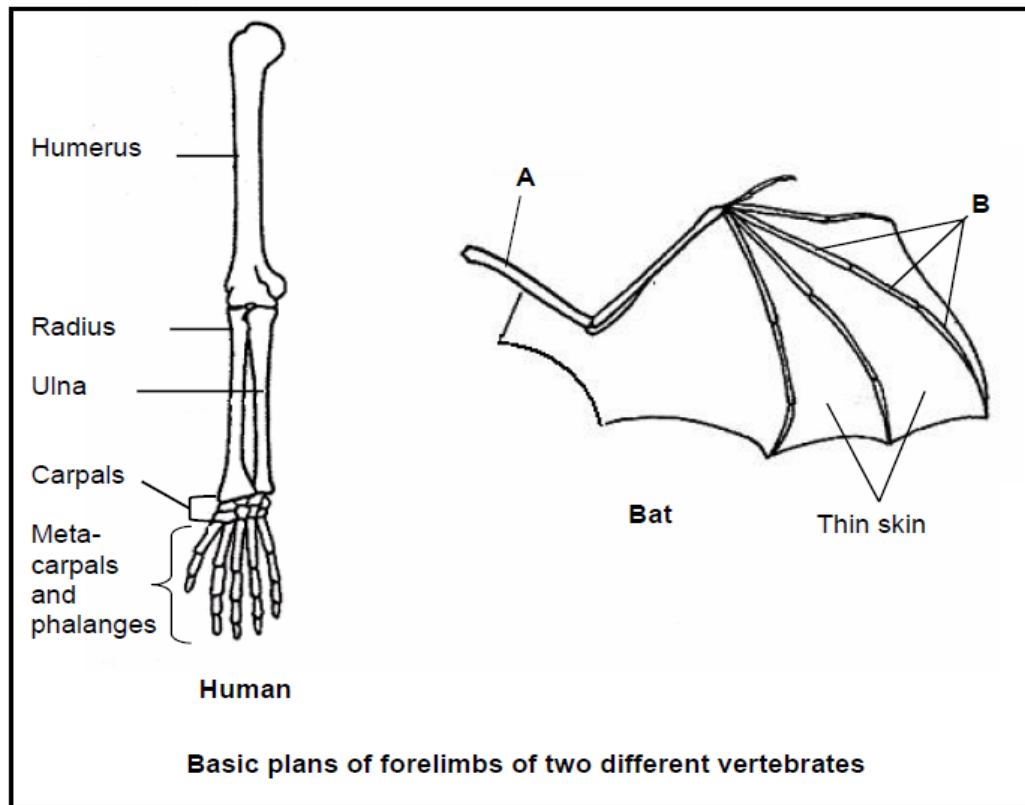


- 3.2.1 Why are the wings on these three different animals said to be analogous? (1)
- 3.2.2 Of what evolutionary process is the above an example? Give a reason for your answer. (2)

ADAPTED BY MR S.J SILAULE

1.4

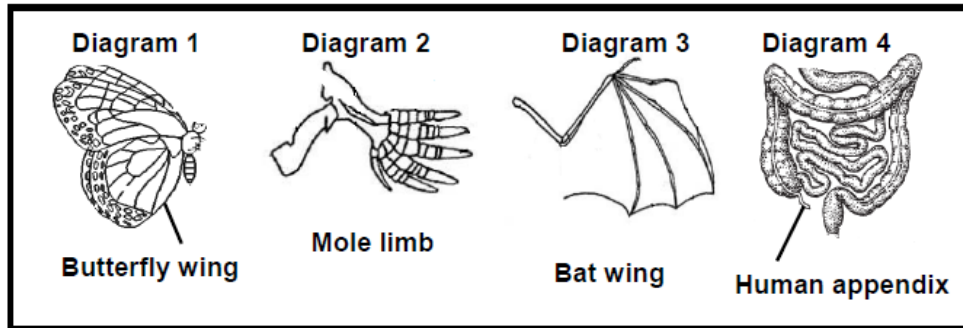
Study the basic plans of the forelimbs of two different vertebrates shown below.



- 1.4.1 Are the above forelimbs homologous or analogous structures? (1)
- 1.4.2 Explain your answer to QUESTION 1.4.1. (2)
- 1.4.3 Using the labels on the forelimb of a human as a guide, give the names of the letters **A** and **B**. (2)
- 1.4.4 State TWO ways in which the forelimb of the bat is adapted for flying. (2)
- (7)**

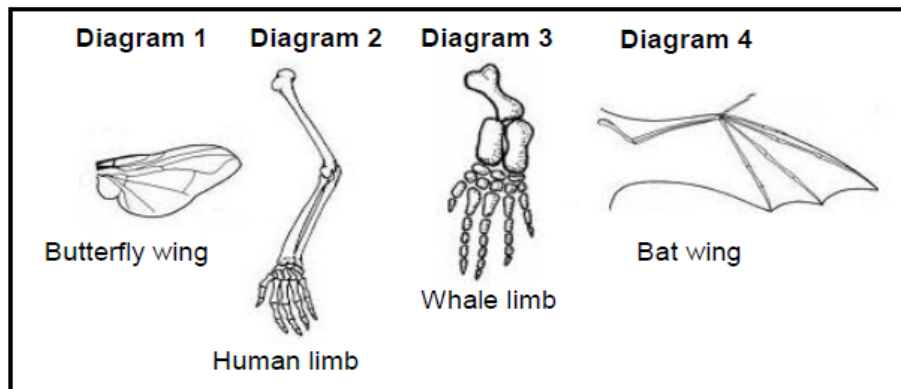
ADAPTED BY MR S.J SILAULE

3.3 Study the diagrams below and answer the questions that follow.



- 3.3.1 (a) Which diagrams represent structures that are analogous? (1)
- (b) Which diagrams represent structures that are homologous? (1)
- 3.3.2 Give a reason for your answer to QUESTION 3.3.1(a). (2)
- 3.3.3 (a) Identify the diagram that has a vestigial structure. (1)
- (b) Explain why it is called a vestigial structure. (2)
- (c) Describe how vestigial structures are used as evidence for evolution. (2)
- (9)

2.4 Study the diagrams below showing structures of different organisms.



- 2.4.1 Which diagram represents a structure that is analogous to the structure in Diagram 4? (1)
- 2.4.2 Write down the numbers of any TWO diagrams that represent homologous structures. (2)
- 2.4.3 What information do analogous and homologous structures provide about evolution? (2)
- (5)

ADAPTED BY MR S.J SILAULE

- 4.1 Study the information about the discovery of a new species of australopithecine in South Africa.

DISCOVERY OF A NEW SPECIES IN SOUTH AFRICA

Professor Lee Berger a paleoanthropologist at the University of the Witwatersrand, with the help of his 9-year-old son, found two fossils in South Africa on 15 August 2008.

Berger and about 60 of his colleagues from all over the world, studied the fossilized bone fragments before they announced their findings to the public on 8 April 2010. Their findings were published in a scientific journal.

They presented it as a new species called *Australopithecus sediba*, dated to approximately 1,78 to 1,95 million years ago. It consists of many primitive features characteristic of other australopithecine species and more advanced features typical of later *Homo* species.

The almost 2-million-year-old partial skeletons are thought to possibly be that of the transitional species between *Australopithecus africanus* (such as the famous Mrs Ples) and either *Homo habilis* or *Homo erectus*, the early ancestors of humans.

Berger said that the brain, hand and foot have characteristics of both modern and early pre-human forms. It represents a model that could have led to the human genus *Homo*.

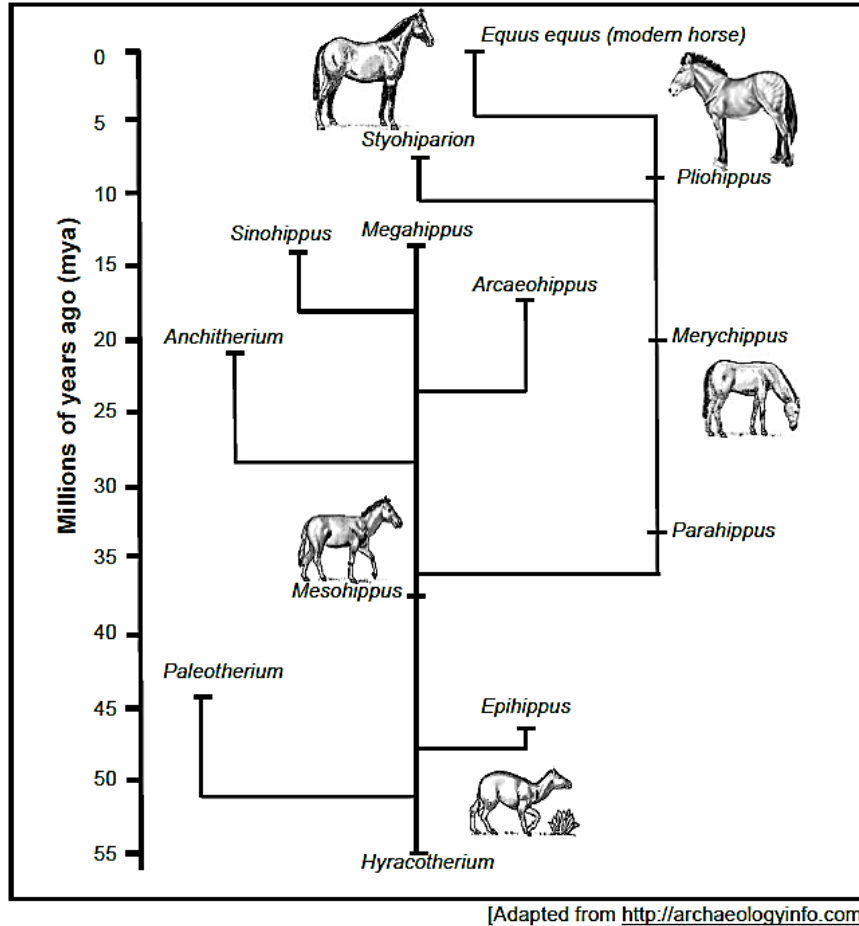
It was noted that the brain of *A. sediba* is small, like that of a chimpanzee, but with a re-organisation more human-like, particularly with an expansion behind and above the eyes.

[Adapted from <http://www.sciencemag.org>]

- 4.1.1 Explain why scientists took a long time to present their findings to the public. (2)
- 4.1.2 Explain why it was important to publish their findings in a scientific journal. (2)
- 4.1.3 Define the term *transitional form*. (2)
- 4.1.4 Use ONE characteristic from the passage to explain your answer to QUESTION 4.1.3. (2)
- 4.1.5 State SIX similarities not mentioned in the passage above, between *Homo sapiens* and other primates such as *Australopithecus sediba*. (6)
- (14)

ADAPTED BY MR S.J SILAULE

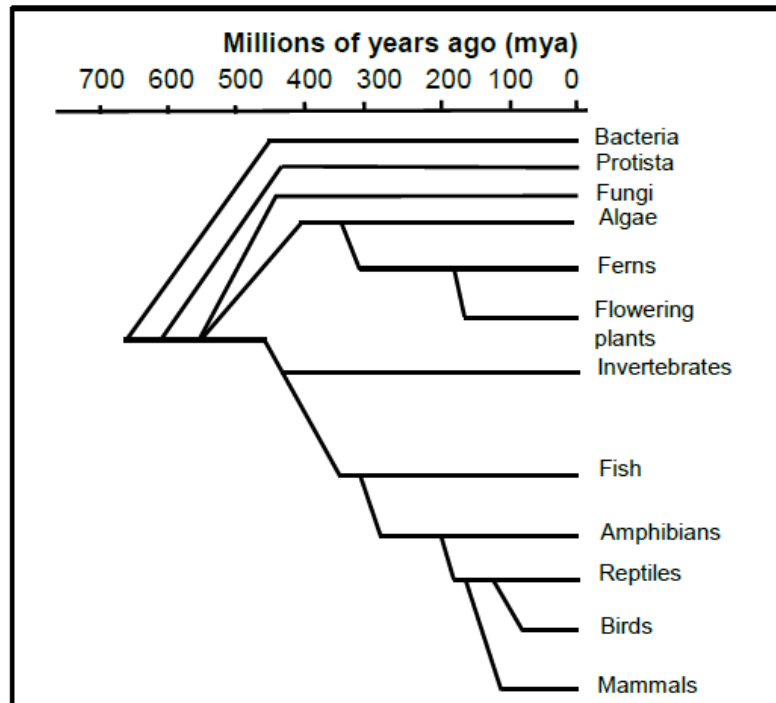
1.6 The diagram below represents the possible evolution of the horse.



- 1.6.1 Name the:
- (a) Common ancestor of all horses (1)
 - (b) Genus most closely related to *Megahippus* (1)
- 1.6.2 When did *Paleotherium* become extinct? (2)
- 1.6.3 How long did it take for the modern horse to evolve from *Hyracotherium*? (2)
- (6)

ADAPTED BY MR S.J SILAULE

1.4 Study the diagram below.



1.4 According to the diagram:

- 1.4.1 How many million years ago did fungi appear on Earth? (1)
- 1.4.2 Which were the first organisms to appear on Earth? (1)
- 1.4.3 Which group is the most recent ancestor to flowering plants? (1)
- 1.4.4 Which group appeared on Earth most recently? (1)
- 1.4.5 Which group of organisms is most closely related to the birds? (1)
- 1.4.6 Give a reason for your answer in QUESTION 1.4.5. (1)

ADAPTED BY MR S.J SILAULE

2. Variation

2.4 Define the following terms:

2.4.1 Population (3)

2.4.2 Species (3)

3.3 Scientists believe that variation in populations can lead to the formation of new species.

3.3.1 List FOUR sources of variation in populations. (4)

2.2 Describe how the following contributes to genotypic variation within a species:

2.2.1 Meiosis (6)

2.2.2 Sexual reproduction (4)
(10)

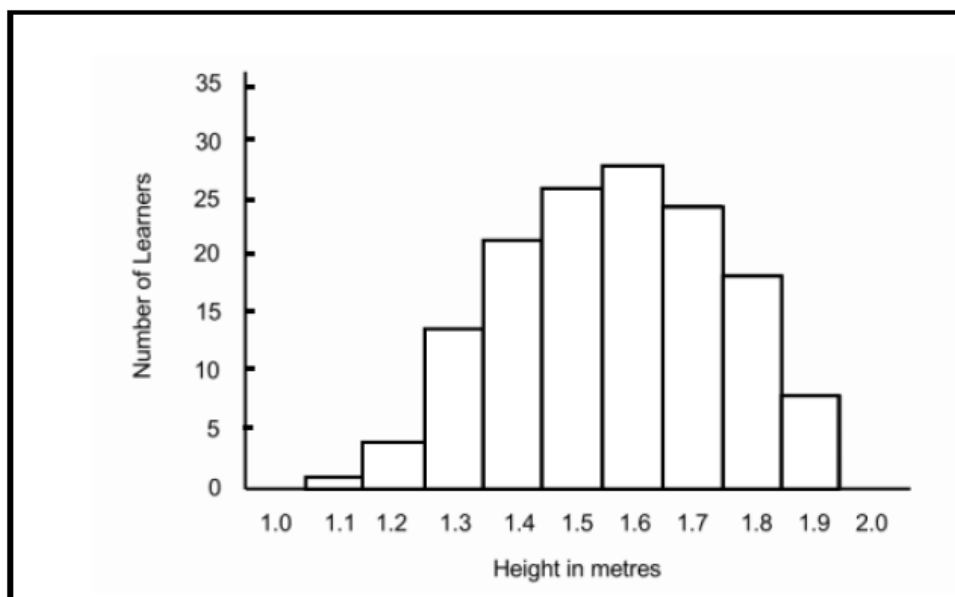
2.2 Mutations result in genetic variation.

2.2.1 Give THREE other sources of genetic variation in a species. (3)

2.2.2 Differentiate between *continuous variation* and *discontinuous variation*. (2)
(5)

ADAPTED BY MR S.J SILAULE

- 2.1 The graph below shows the variation of heights of a group of 18-year-old students.



- 2.1.1 Identify the type of graph represented. (1)
- 2.1.2 Explain why this type of graph mentioned in QUESTION 2.1.1 is most suitable for plotting data on continuous variation. (2)
- 2.1.3 What is the most common height? (1)
- 2.1.4 How many people in the group were shorter than 1.3 metres? (1)
- (5)

ADAPTED BY MR S.J SILAULE

3. Origin of an idea about origins

2.2 The following questions refer to Lamarck's explanation of evolution:

2.2.1 Describe the idea proposed by Lamarck to explain evolution. (4)

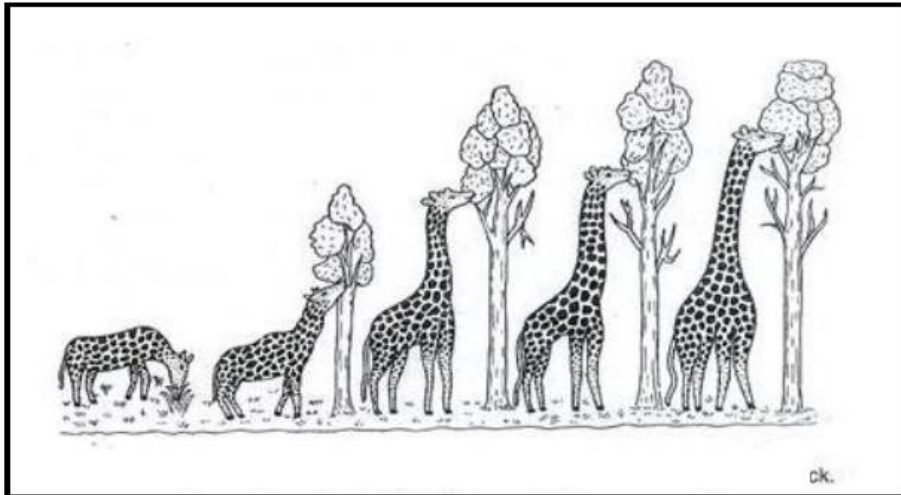
2.2.2 State why Lamarck's explanation is not accepted by most scientists today. (2)

3.2 Lamarck based his theory of evolution on two principles, ideas or 'laws'.

3.2.1 Name and describe TWO principles that Lamarck used to explain how evolution took place. (6)

3.2.2 Give ONE reason why Lamarck's theory is NOT accepted. (2)
(8)

3.3 The diagram below shows the elongation of the neck of the giraffe according to Lamarck.

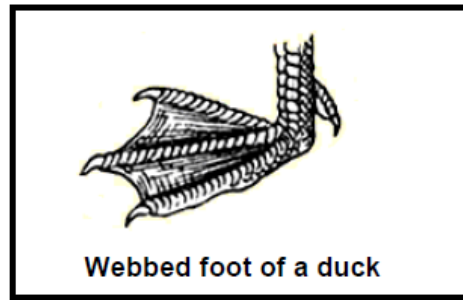


3.3.1 Use the example in the diagram to describe Lamarck's theory for changes in the giraffe's neck over time. (3)

3.3.2 Why was Lamarck's theory rejected? (2)
(5)

ADAPTED BY MR S.J SILAULE

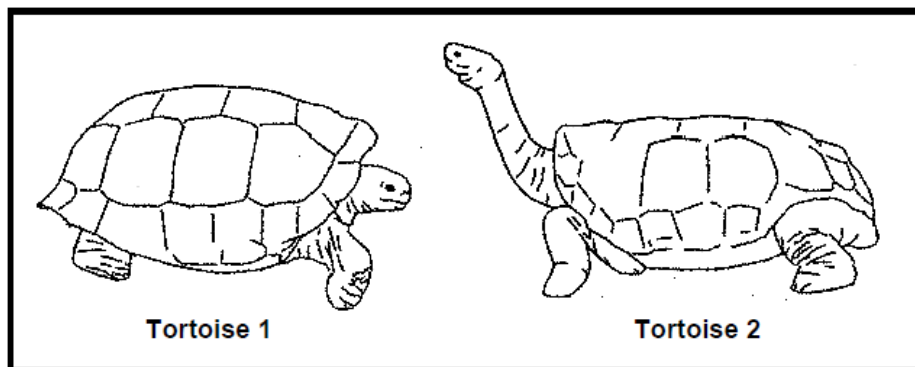
- 2.1 Study the diagram of a duck's foot below.



Ancestors of ducks did not have webbed feet. In terms of natural selection, explain how the webbed feet could have evolved.

(7)

- 3.1 Darwin noticed different species of tortoises on the Galapagos Islands. Two of these tortoises, which are drawn to scale, are shown below.



- 3.1.1 Tabulate TWO visible differences between the two species of tortoises.
- 3.1.2 Suggest what tortoise 2 may eat that tortoise 1 will not be able to eat.
- 3.1.3 The two species of tortoises shown above lived on different islands. Darwin suggested that they might have evolved from a common ancestor. Explain how this could have occurred.

(5)

(1)

(6)
(12)

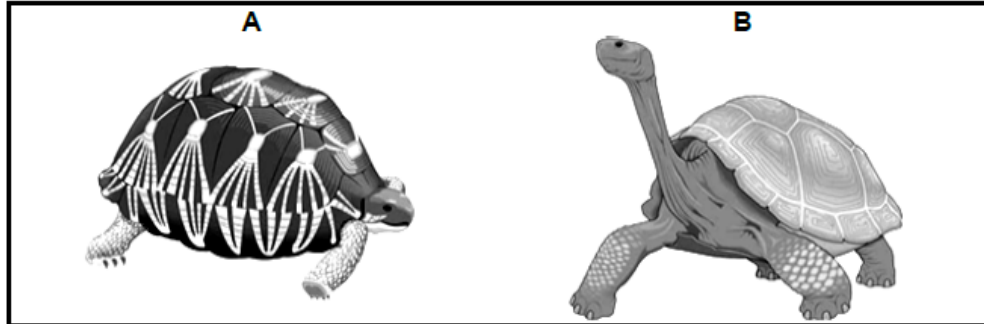
ADAPTED BY MR S.J SILAULE

- 3.2 During his journey Darwin discovered that there were different species of tortoises on each of the two different islands.

One had a domed shell and short neck and the other one had a longer neck.

The two islands had different vegetation. One of the islands (Island X) was rather dry. It had no grass, but rather short, tree-like cactus plants.

On the other island (Island Y), there were no cactus plants but it had a good supply of water and grass grew across the island.



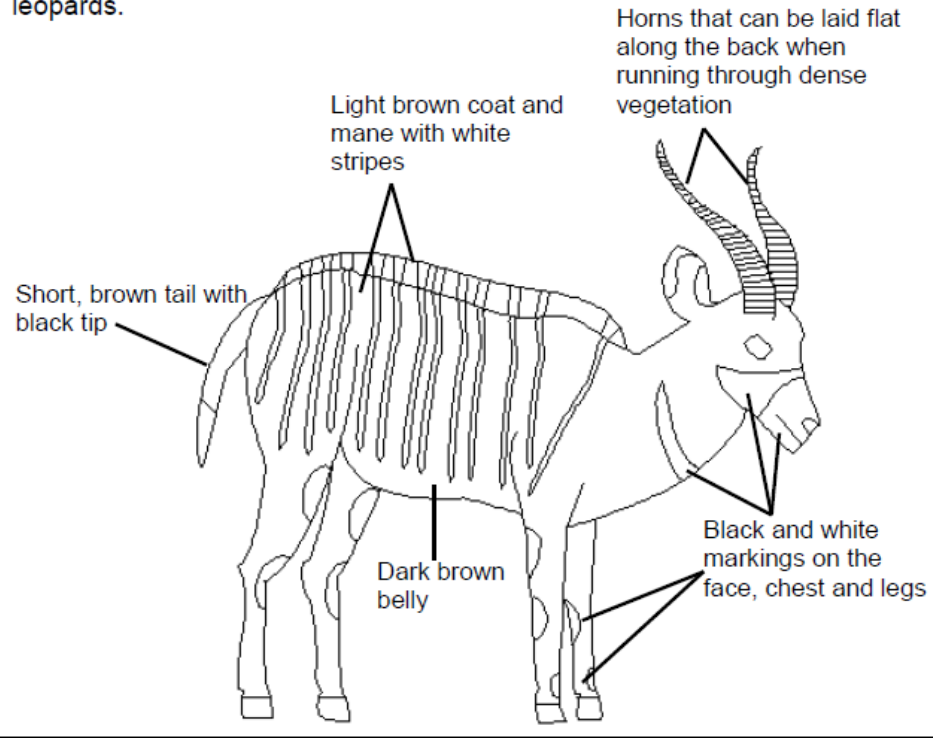
- 3.2.1 Which tortoise (A or B) would have been found on Island Y? (1)

- 3.2.2 Darwin suggested that these two species on the different islands might have evolved from a common ancestor from the mainland. Explain how this could have occurred. (9)
(10)

ADAPTED BY MR S.J SILAULE

- 2.4 The extract and the diagram below provide information about a type of antelope called a Bongo.

The Bongo is a large antelope species that is active at night and found in the dense jungles and forests of Africa. The dense forests have very little ground vegetation so the Bongo feeds in forest openings where new herbs and shrubs grow closer to the ground. They are preyed on by lions and leopards.

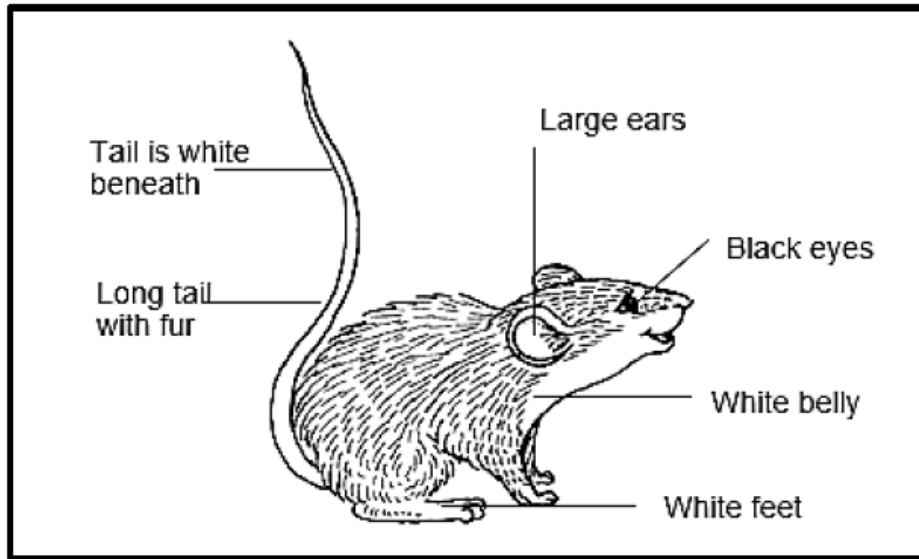


- 2.4.1 State TWO characteristics that help the Bongo to camouflage themselves in the dense jungle. (2)
- 2.4.2 Use your knowledge of natural selection and explain how the Bongo's ability to lay its horns along its back could have developed over the years. (5)
(7)

ADAPTED BY MR S.J SILAULE

- 3.2 Deer mice live in different habitats of North America. All have soft fur but the colour varies. Species living in dark, wet forests tend to have dark fur whereas those living in deserts with light sand dunes tend to have light coloured fur. Deer mice are preyed upon by owls.

The picture below shows a deer mouse.



- 3.2.1 State ONE characteristic of the deer mouse which allows it to avoid predators. (1)
- 3.2.2 Use your understanding of natural selection to explain how the development of the allele for light coloured fur allowed the deer mice to survive in the sand dunes of Nebraska. (6)

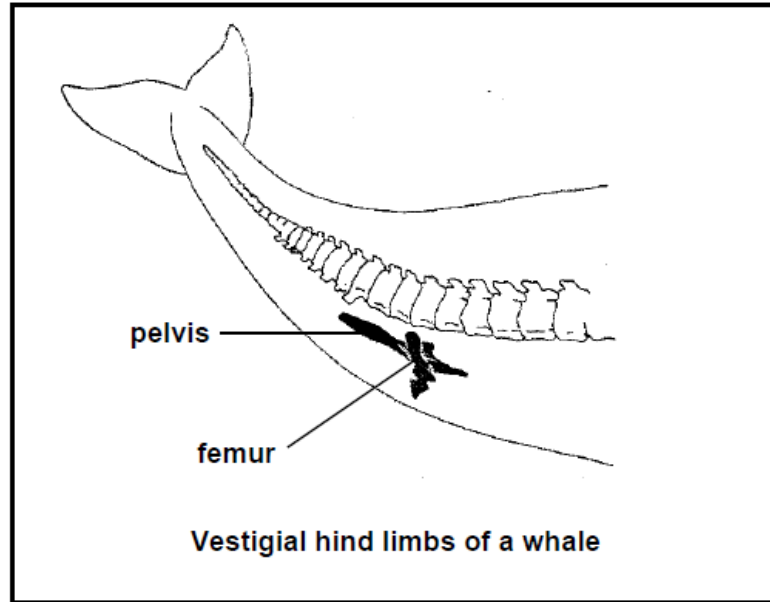
ADAPTED BY MR S.J SILAULE

3.2 Darwin said in his book:

"Organs or parts which seem useless are very common in nature. In many snakes there are small bones of the pelvis and hind limbs."

[On the Origin of Species, Darwin, 1858, p. 428]

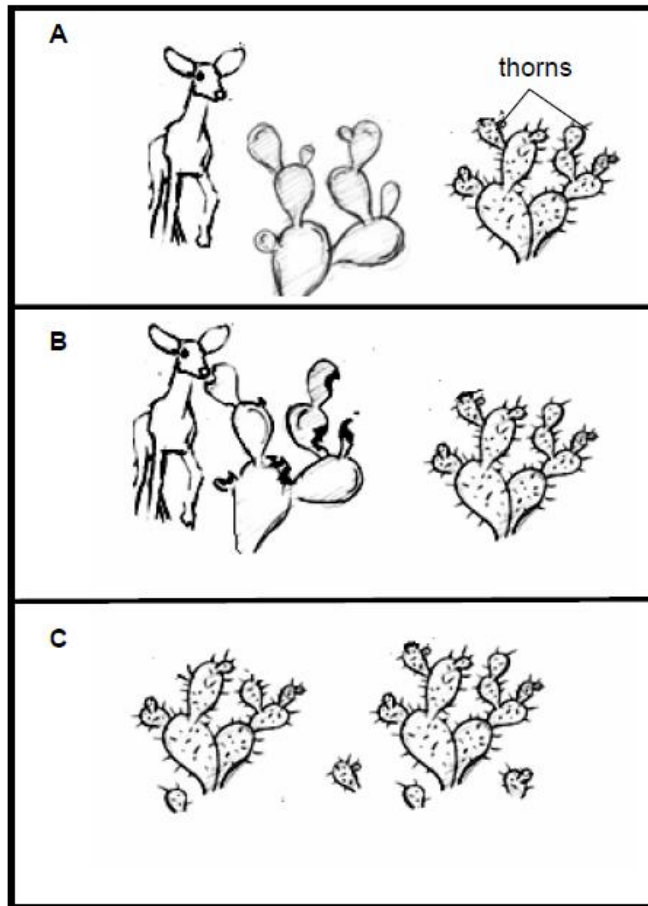
The diagram below shows the vestigial (reduced) pelvis and femur of a whale.



- 3.2.1 In terms of natural selection, explain how the pelvis and femur that were once useful to the whale's ancestor, could have become vestigial in modern whales. (5)
- 3.2.2 Suggest ONE reason why a vestigial structure, once it has been reduced to a certain size, may not disappear altogether. (2)
(7)

ADAPTED BY MR S.J SILAULE

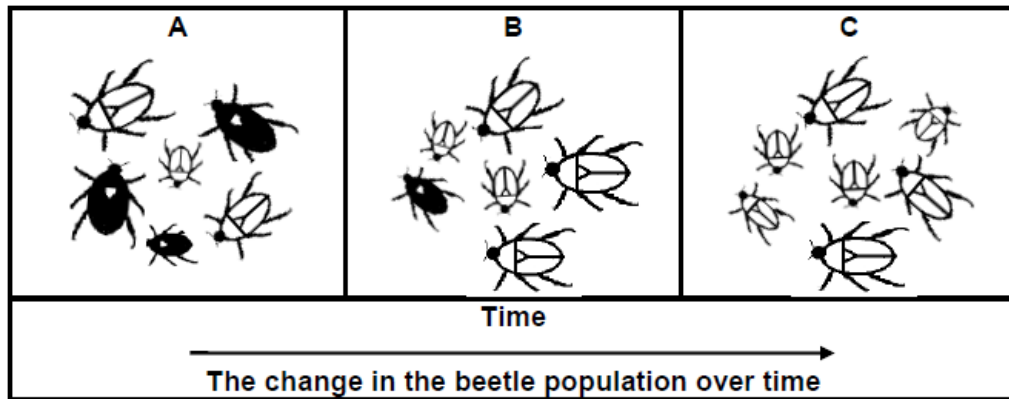
- 2.3 Below is a sequence of diagrams (A, B and C) representing the changes in a population of cactus plants on which bucks feed over a period of time.



- 2.3.1 Which evolutionary process is represented by the above diagrams? (1)
- 2.3.2 Use the diagrams A, B and C above to explain the process mentioned in QUESTION 2.3.1. (5)
- (6)

ADAPTED BY MR S.J SILAULE

- 2.1 Study the three diagrams (**A**, **B** and **C**) below that show how a population of beetles changed over a long period of time.

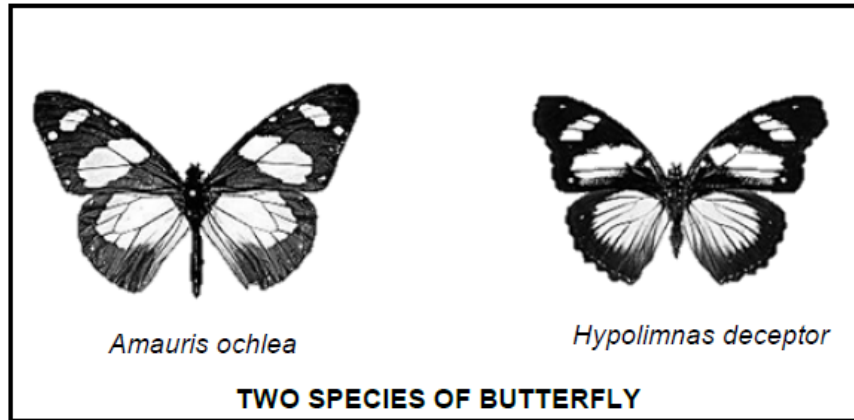


- 2.1.1 By comparing diagrams **A** and **B**, state the characteristic of the beetles that have enabled their offspring to survive. (1)
- 2.1.2 Name the mechanism that is illustrated in these diagrams. (1)
- 2.1.3 Use the **THREE** diagrams above to explain the mechanism named in QUESTION 2.1.2. (6)
- (8)

ADAPTED BY MR S.J SILAULE

- 3.1 The photographs of two butterflies are provided below. Both butterflies live in the same habitat and are preyed on by predators. Although these butterflies are very similar in appearance they are two separate biological species.

Amauris ochlea has an unpleasant taste while *Hypolimnas deceptor* does not have an unpleasant taste.



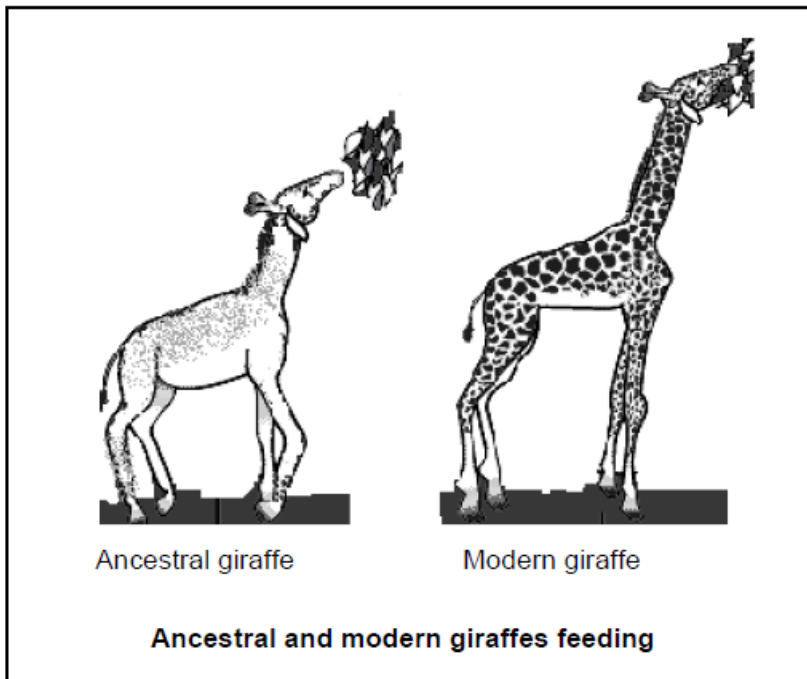
[From <http://www.biodiversityexplorer.org>.]

- 3.1.1 Explain why most predators are less likely to feed on *Hypolimnas deceptor*. (3)
- 3.1.2 Use Darwin's theory of evolution through natural selection to explain the evolution of the *Hypolimnas deceptor* butterfly. (6)
- 3.1.3 State ONE way in which natural selection differs from artificial selection. (2)
- (11)**

ADAPTED BY MR S.J SILAULE

- 2.2 Both Darwin and Lamarck proposed theories to explain the origin of new species.
- 2.2.1 State the FOUR observations upon which Darwin based his theory. (4)
- 2.2.2 Tabulate TWO differences between Lamarck's and Darwin's theories. (5)
(9)

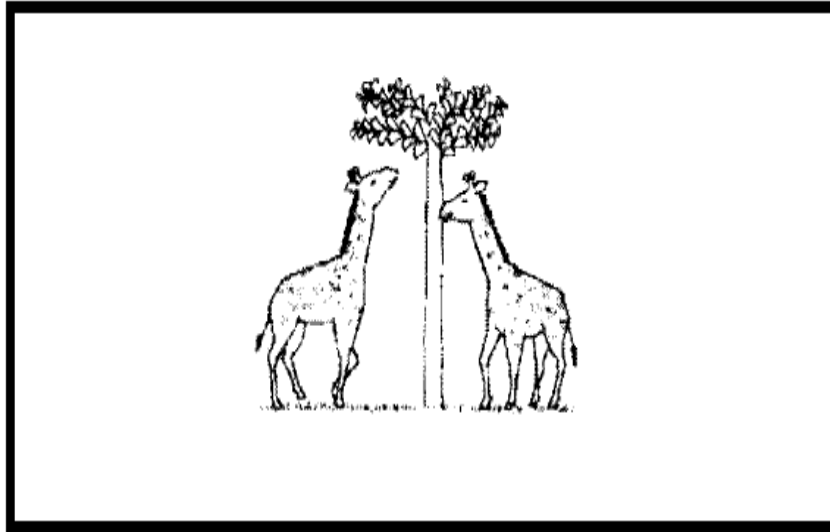
- 2.1 Tens of thousands of years ago, the animals that evolved into giraffes were not as tall as modern giraffes. Over a long period of time, the necks of giraffes became longer. They could reach leaves high in the trees and reach down for water.



- 2.1.1 Describe how the long necks of modern giraffes would have been explained by the following:
- (a) Darwin (4)
- (b) Lamarck (4)
- 2.1.2 Explain why Lamarck's theory is not accepted. (2)

ADAPTED BY MR S.J SILAULE

- 2.1 Giraffes feed on the leaves of trees and are adapted, through evolution, to survive in their environment as shown in the illustration below:



- 2.1.1 In what way is the giraffe adapted to its environment? (2)
- 2.1.2 Explain how Jean-Baptiste Lamarck accounted for the evolution of the giraffe. (3)
- 2.1.3 Explain how Charles Darwin accounted for the evolution of the giraffe. (3)
- 2.1.4 Explain the impact of Mendel's laws of heredity on Lamarck's hypothesis. (2)

ADAPTED BY MR S.J SILAULE

3.2 Read the extract below.

The red-bellied black snake (*Pseudechis porphyriacus*) and the green tree snake (*Dendrelaphis punctulatus*) are predators that sometimes feed on cane toads (*Bufo marinus*) that contain a toxin that may kill them.

The snakes consume the toads by swallowing them whole. A decrease in the average jaw size of the snakes has been observed over a period of 70 years. Some scientists believe that this may be an example of punctuated equilibrium. With this change it was also noted that the snakes could no longer swallow the large cane toads. This has resulted in an increase in the survival of the snakes.

- 3.2.1 Define *punctuated equilibrium*. (3)
- 3.2.2 What characteristic of the toad species protects it from predation? (1)
- 3.2.3 Explain how the change in jaw size helped the snakes to survive. (3)
- 3.2.4 How would Lamarck have explained the development of a small jaw size in the snakes? (4)
- (11)

3.4 There has been a change of thinking with regards to the pace of evolution moving from gradualism as proposed by Darwin to punctuated equilibrium.

Describe punctuated equilibrium and how it demonstrates the pace at which evolution occurs. (4)

ADAPTED BY MR S.J SILAULE

4. Artificial selection

- | | | | |
|-----|-------|---|-----|
| 2.5 | 2.5.1 | Explain ONE advantage of inbreeding. | (2) |
| | 2.5.2 | List THREE disadvantages of inbreeding. | (3) |

- 3.5 Tabulate THREE differences between natural selection and artificial selection. (7)
- 3.6 Give ONE similarity between natural selection and artificial selection. (2)
- 3.7 Read the following article on the Bonsmara cattle breed and answer the questions that follow.

While working as a research officer at the Department of Agriculture's Mara Research Station near Musina in Limpopo, Prof Jan Cornelis Bonsma made several breakthroughs in the field of adaptation physiology and experimental breeding, which eventually led to the creation of the well-known Bonsmara cattle breed.

The Bonsmara is a breed of cattle that is known for its high quality beef. The Bonsmara was created after many matings consisting of 5/8 Afrikaner (Sanga-type), 3/16 Hereford and 3/16 Shorthorn animals (both Taurine-type).

[Adapted from: www.up.co.ac/2011]

- 3.7.1 Through which process was the Bonsmara cattle breed developed? (1)
- 3.7.2 Explain your answer in QUESTION 3.7.1 by referring to the previous article. (3)
- 3.7.3 Did the process mentioned in QUESTION 3.7.1 involve inbreeding or outbreeding? (1)

ADAPTED BY MR S.J SILAULE

- 3.2 *Brassica* plants have hairs on their leaves to reduce transpiration. The number of hairs on the leaves vary from plant to plant.

An investigation was conducted to determine whether artificial selection could increase the number of plants with more hairs on the leaves.

The students carried out the following procedure:

- 180 *Brassica* plants were grown. This is the first generation.
- The number of hairs present on the edge of each mature leaf was counted per plant and an average was calculated.
- The number of plants, with their averages, was counted and recorded.
- The plants with the most hairs, i.e., 25 or more hairs on the leaves were separated from the rest of the group and cross pollinated with one another.
- The seeds produced by these crosses were germinated and allowed to grow into plants. 180 of these plants were selected to represent the second generation.
- The number of hairs present on the edge of a mature leaf from each of the second generation of plants was recorded.

The results of the investigation are shown below.

WITHOUT ARTIFICIAL SELECTION		WITH ARTIFICIAL SELECTION	
Average number of hairs	Number of plants	Average number of hairs	Number of plants
0-5	50	0-5	8
6-10	35	6-10	5
11-15	24	11-15	18
16-20	20	16-20	25
21-25	25	21-25	35
26-30	12	26-30	45
31-35	8	31-35	30
36-40	6	36-40	14

[Adapted from: www.media.collegeboard.com]

ADAPTED BY MR S.J SILAULE

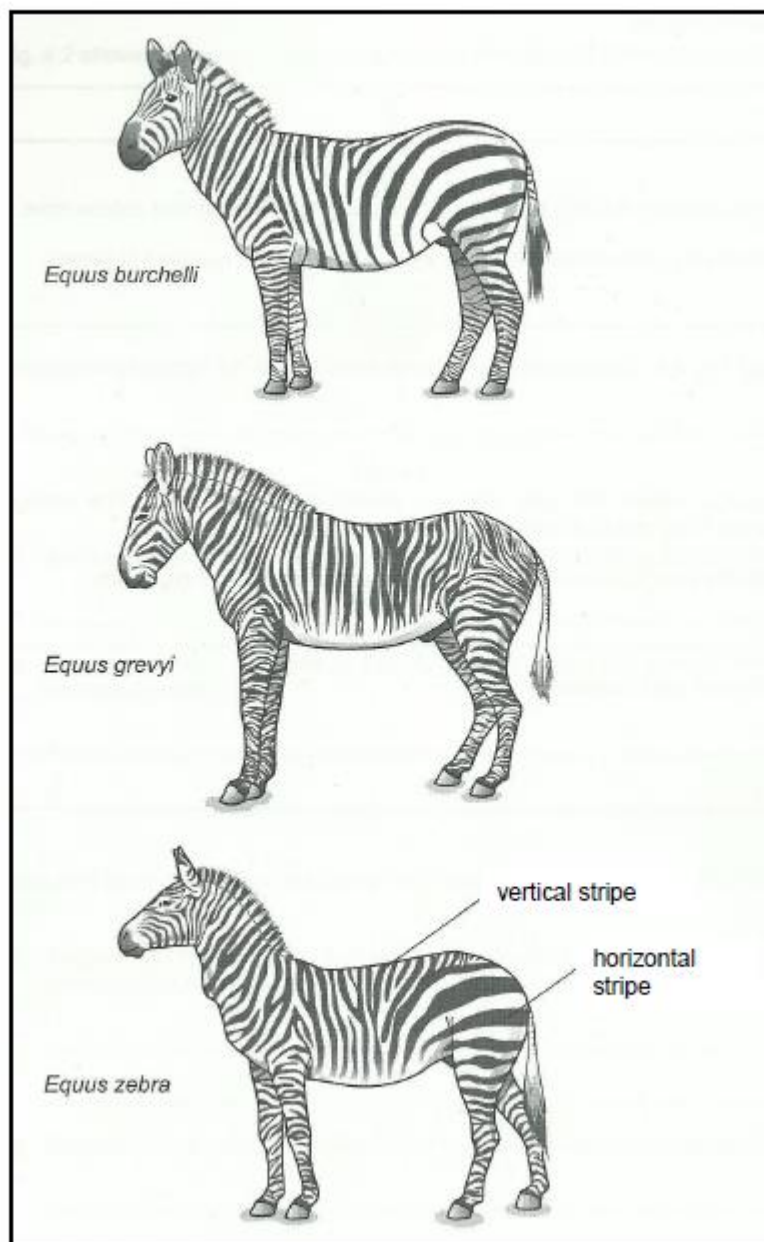
- 3.2.1 Identify the:
- (a) Independent variable (1)
 - (b) Dependent variable (1)
- 3.2.2 State TWO ways in which the students ensured that this investigation was valid. (2)
- 3.2.3 Give a conclusion for this investigation. (2)
- 3.2.4 State TWO ways in which the learners could have made their results more reliable. (2)
- 3.2.5 Draw a histogram showing the results with artificial selection. (6)
- 3.2.6 Describe TWO differences between natural and artificial selection. (4)
- (18)**

5. Formation of new species

- 3.3 Scientists believe that variation in populations can lead to the formation of new species.
- 3.3.2 Explain how speciation occurs if a population becomes separated into two groups by a geographical barrier such as a mountain. (6)

ADAPTED BY MR S.J SILAULE

1.4 Study the diagrams of three species of zebra.



ADAPTED BY MR S.J SILAULE

1.4.1 Studies have shown that the hotter the environment, the more stripes zebras have.

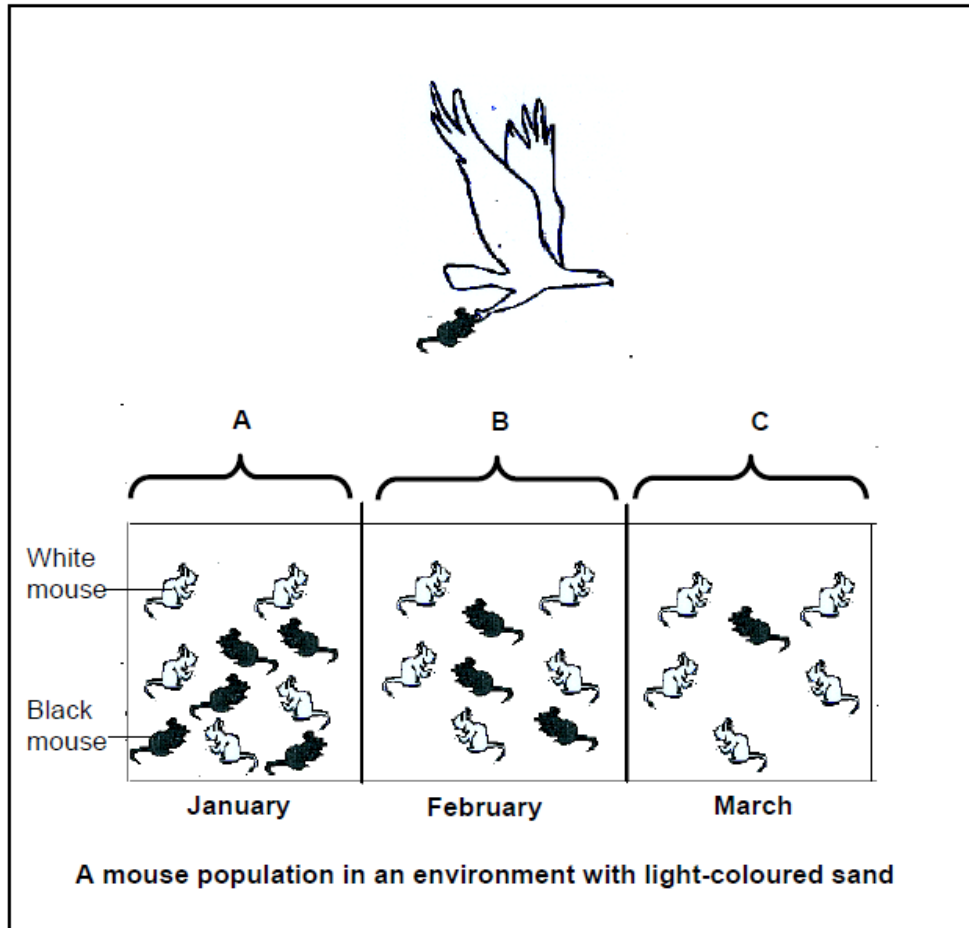
- (a) What type of genetic variation would result in different numbers of stripes? (1)
- (b) What is a biological species? (2)
- (c) Which species of zebra lives in the hottest environment? (1)

1.4.2 Occasionally, zebras are born that are almost completely black. The change in appearance is the result of mutation.

- (a) Give the term that is used to describe the appearance of an organism. (1)
 - (b) Differentiate between a *gene mutation* and a *chromosomal aberration*. (2)
- (7)

ADAPTED BY MR S.J SILAULE

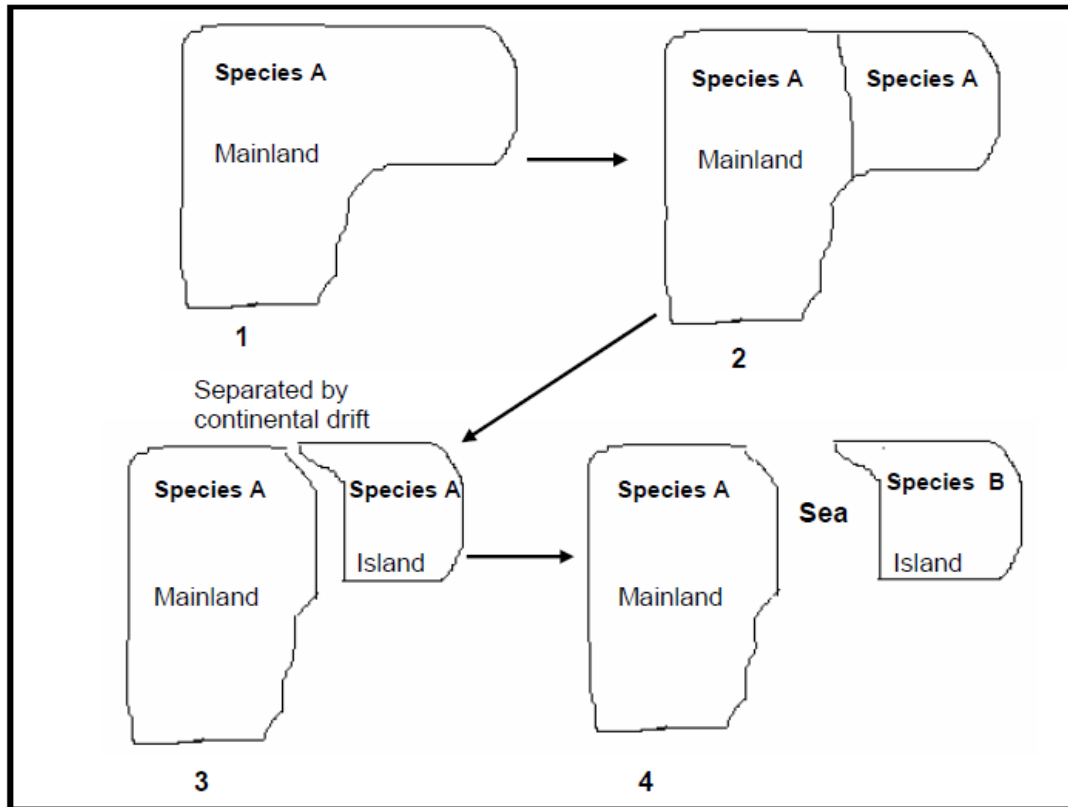
- 2.3 Study the diagram below that shows the change in numbers of black and white mice living in an environment with light-coloured sand.



- 2.3.1 What phenomenon is illustrated in the diagram? (1)
- 2.3.2 Describe how the sequence of events labelled A, B and C represents the phenomenon named in QUESTION 2.3.1. (5)
- 2.3.3 Will the next generation of mouse population more likely be all white or all black? (1)

ADAPTED BY MR S.J SILAULE

- 3.2 Study the following diagrams which show different stages (1 to 4) of a process in evolution.

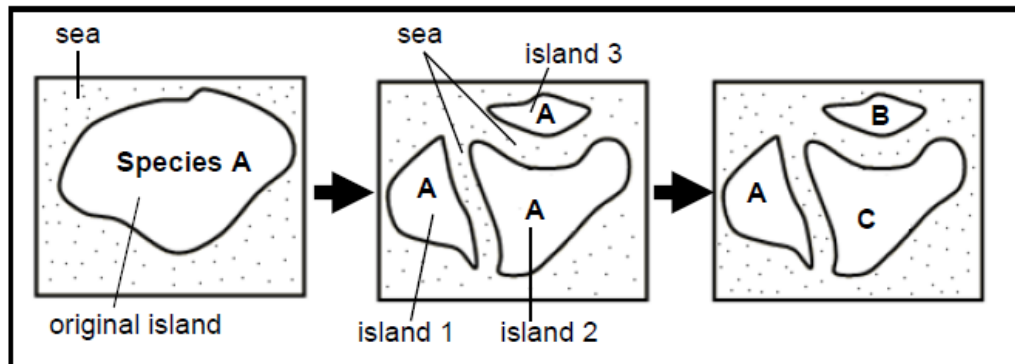


- 3.2.1 Name the evolutionary process that resulted from the continental drift shown. (1)
- 3.2.2 Describe how the original population of species A split to become two species as indicated in the diagrams above. (5)

ADAPTED BY MR S.J SILAULE

2.1 The diagrams below represent the process of speciation in tortoises.

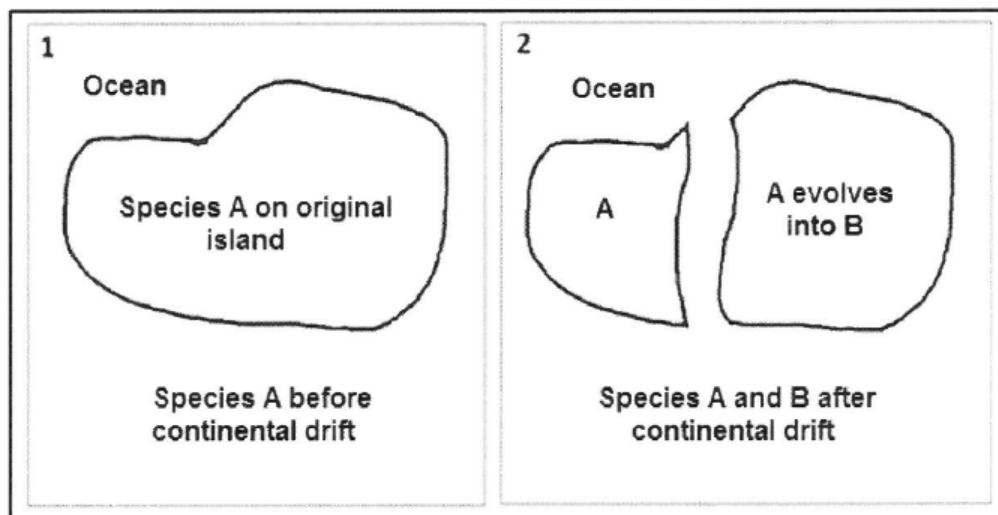
Over a period of time species **B** and **C** evolved from species **A**.



2.1.1 Explain why species **A** continued to exist on island 1. (2)

2.1.2 Describe how species **B** and **C** evolved from species **A**. (6)
(8)

2.2 The following diagrams show a process in evolution taking place on an island that split into two parts.

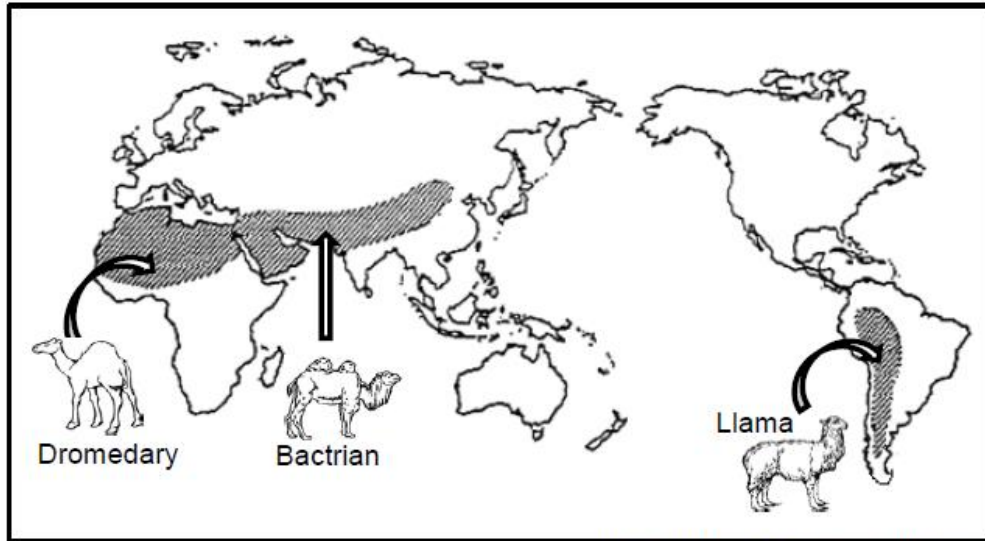


2.2.1 Name the evolutionary process that resulted from the continental drift shown above. (1)

2.2.2 Describe how the original population of species **A** split to become two species as indicated in the diagrams above. (6)
(7)

ADAPTED BY MR S.J SILAULE

- 3.3 The diagram below shows the distribution of members of the camel family on the different continents. The arrows indicate the current distribution of the animals.



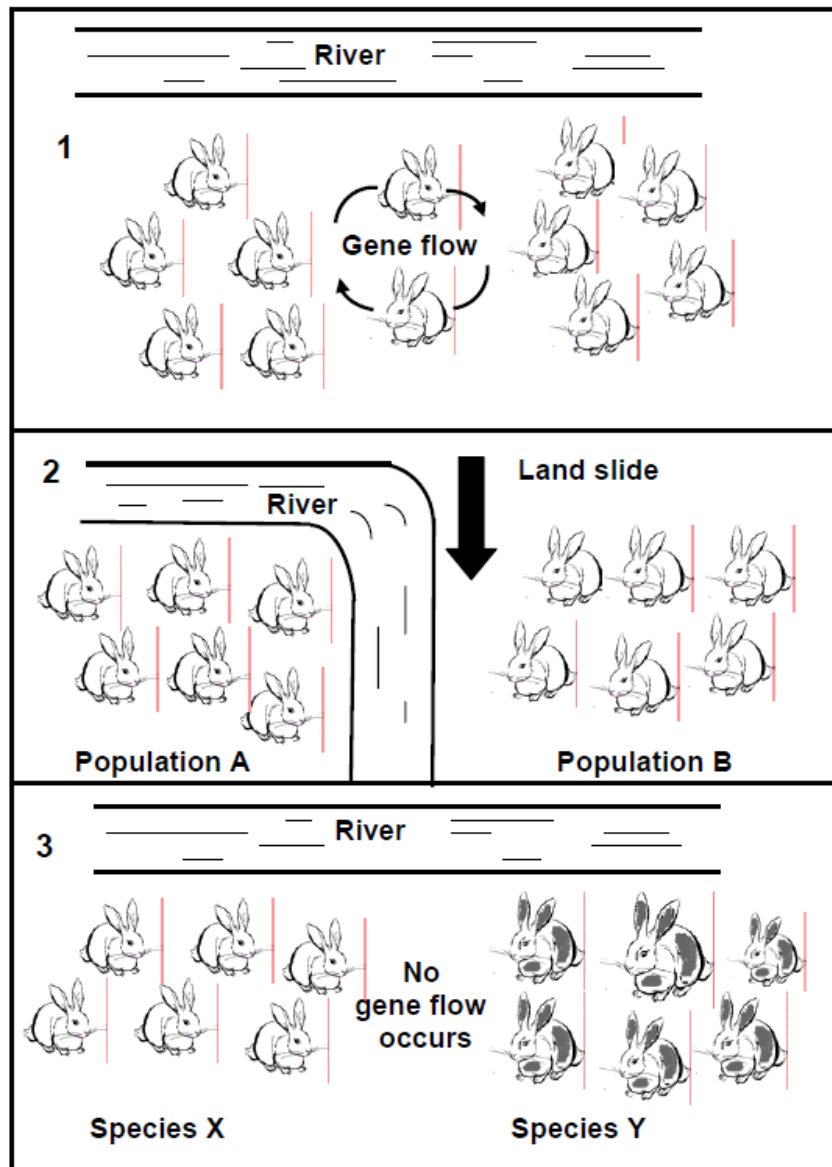
[Adapted from <http://www.ck12.org>]

Explain how speciation of camels may have occurred.

(6)

ADAPTED BY MR S.J SILAULE

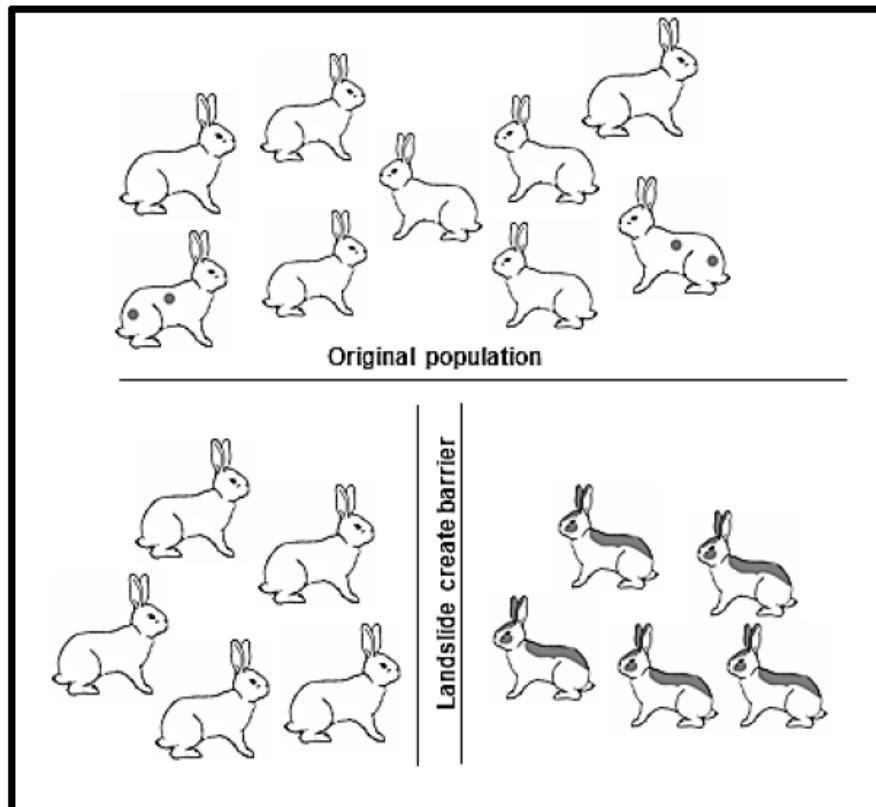
- 3.4 Study the diagrams below showing a process of evolution. DIAGRAMS 1, 2 and 3 show the sequence of events that occurred in rabbit populations over many thousands of years.



- 3.4.1 Name the evolutionary process represented by the sequence of events shown in DIAGRAMS 1, 2 and 3 above. (1)
- 3.4.2 Describe the process stated in QUESTION 3.4.1 using the diagrams above. (5)
(6)

ADAPTED BY MR S.J SILAULE

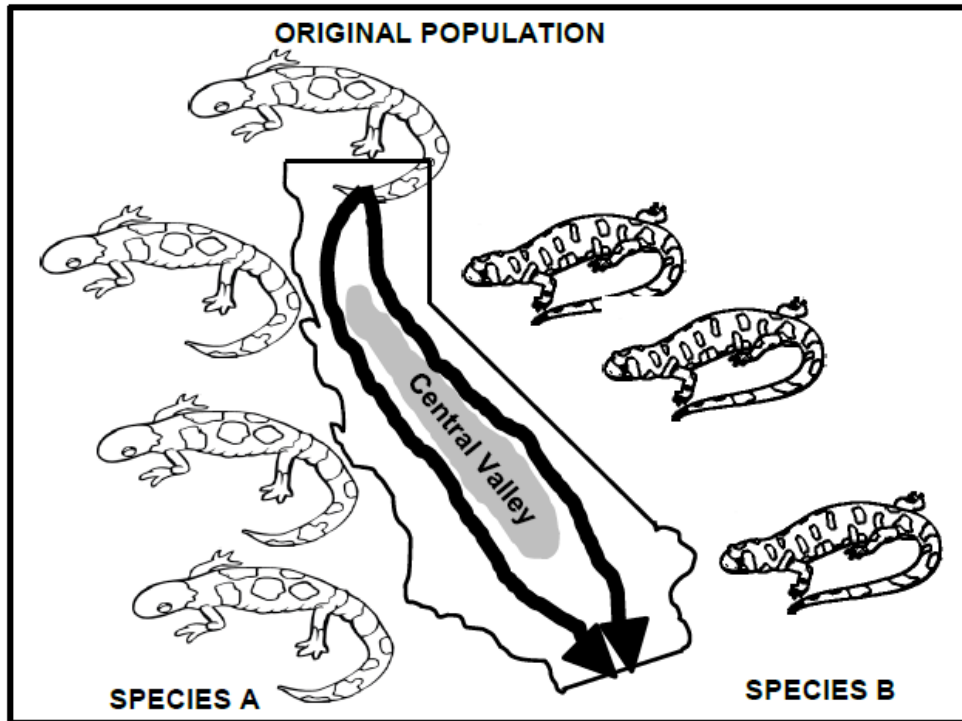
- 3.3 The diagrams below show a process of evolution. The diagrams illustrate the events that occurred in the rabbit population over many years. Study them and answer the questions that follow.



- 3.3.1 What evolutionary process is illustrated in the diagram above? (1)
- 3.3.2 Use the diagram to explain how the two new species evolved from the original population. (6)
- 3.3.3 State ONE observable difference between the two new species. (1)

ADAPTED BY MR S.J SILAULE

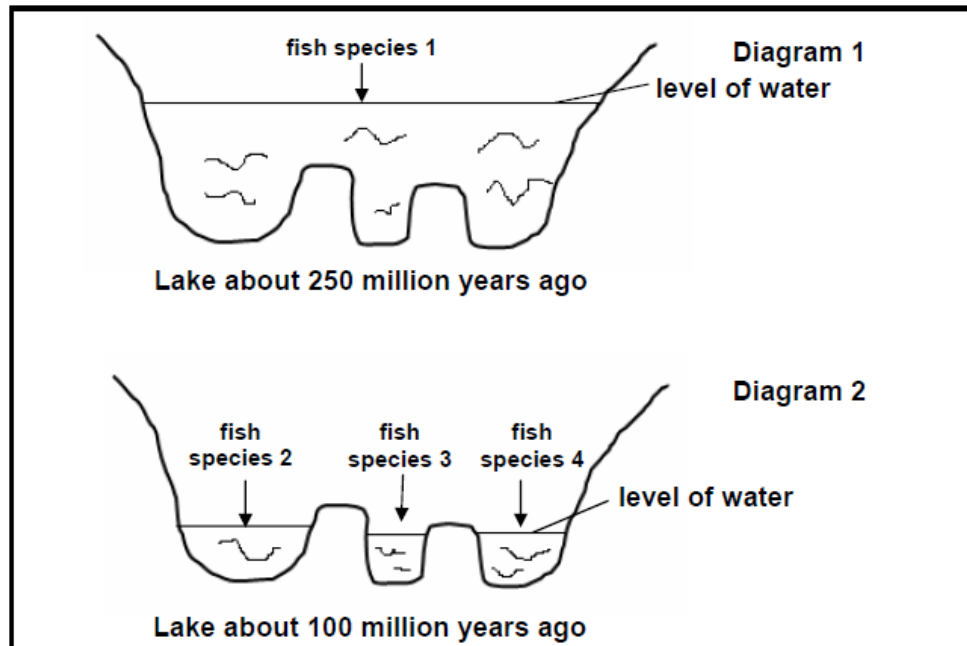
- 3.3 The diagram below shows an evolutionary process taking place in a population of salamanders in California. The process took place gradually, millions of years ago. Study the diagram and answer the questions that follow.



- 3.3.1 What evolutionary process is illustrated in the diagram above? (1)
- 3.3.2 Use the diagram to explain how the Species B evolved from the original population. (6)
- 3.3.3 Explain why this is not an example of punctuated equilibrium. (3)

ADAPTED BY MR S.J SILAULE

- 2.1 The diagrams below show the change in fish species in a lake from 250 million years ago to 100 million years ago. The water level in the lake had dropped and formed three smaller lakes during this period.

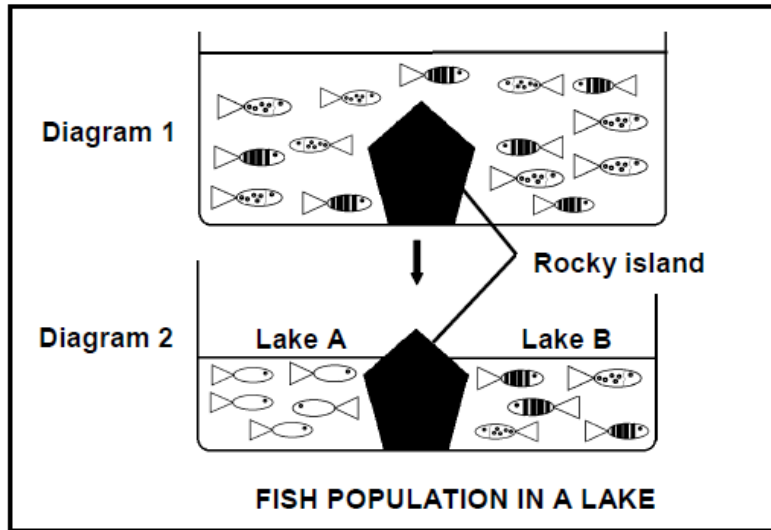


- 2.1.1 Which process is illustrated in the diagrams above? (1)
- 2.1.2 Describe the process named in QUESTION 2.1.1 as it occurred in the lake shown above. (7)
- (8)

ADAPTED BY MR S.J SILAULE

- 2.1 Diagram 1 shows variation in a species of fish living in a lake. There was a rocky island that extended across the whole length of the lake, but it was under water due to the high water level. The fish were therefore able to move freely throughout the lake.

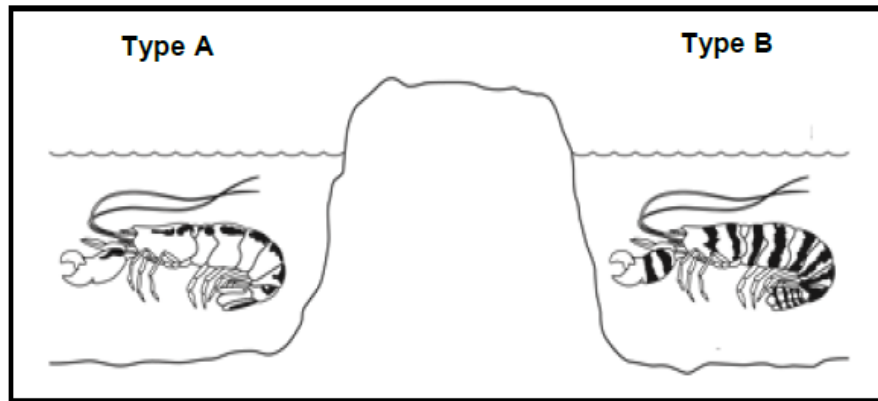
Diagram 2 shows the same lake many years later. A drought had caused the level of the water in the lake to drop so that the rocky island in the centre separated the lake into two smaller lakes, **A** and **B**, for a long period of time.



- 2.1.1 Define *population*. (2)
- 2.1.2 State FOUR possible causes of the variation in the fish population in Diagram 1. (4)
- 2.1.3 Eventually, as shown in Diagram 2, lake **A** and lake **B** contained two different species of fish.
- (a) Name the process that resulted in the fish population becoming two different species. (1)
- (b) Explain how the new species was formed. (6)
- (13)

ADAPTED BY MR S.J SILAULE

- 2.2 The diagram below represents two types of shrimp. Each type lives in shallow seas on opposite sides of a strip of land.



[Adapted from www.pbs.org/wgbh/evolution/library]

In an investigation to determine whether the two types of shrimp were from one species, scientists placed type A shrimps and type B shrimps together in a tank of seawater.

Although the shrimps mated with their own types, the two types of shrimp did not mate with each other. The scientists repeated the investigation several times and obtained the same result each time.

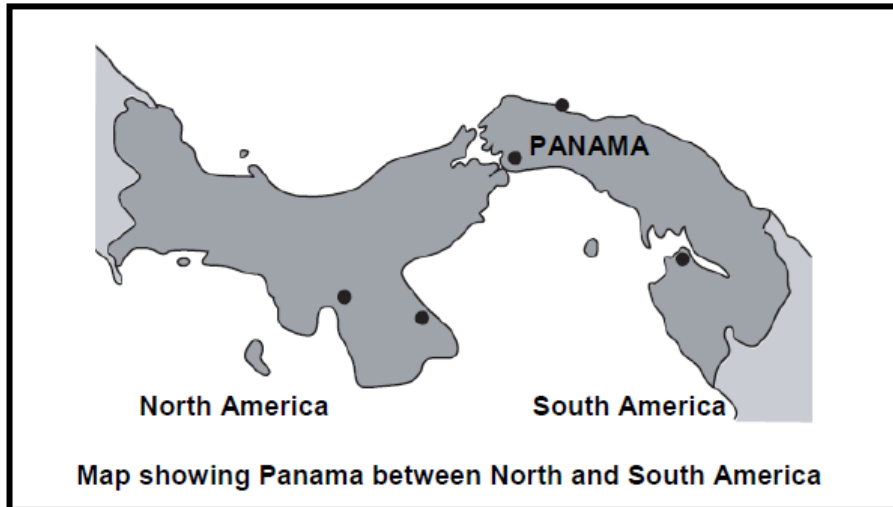
- 2.2.1 Give ONE conclusion the scientists came to after the investigation. (1)
- 2.2.2 Explain your answer to QUESTION 2.2.1. (2)
- 2.2.3 Why did the scientists repeat the investigation? (1)
- (4)

ADAPTED BY MR S.J SILAULE

3.1 Read the passage below and answer the question that follows.

Panama is a narrow strip of land that joins North and South America. This narrow strip of land formed approximately 3 million years ago.

Shrimps (sea organisms), genus *Alpheus*, can be found on either side of Panama. The two groups are phenotypically similar. However, when the males and females from either side of the narrow strip were brought together, they were not able to mate. They are now considered to be two different species.

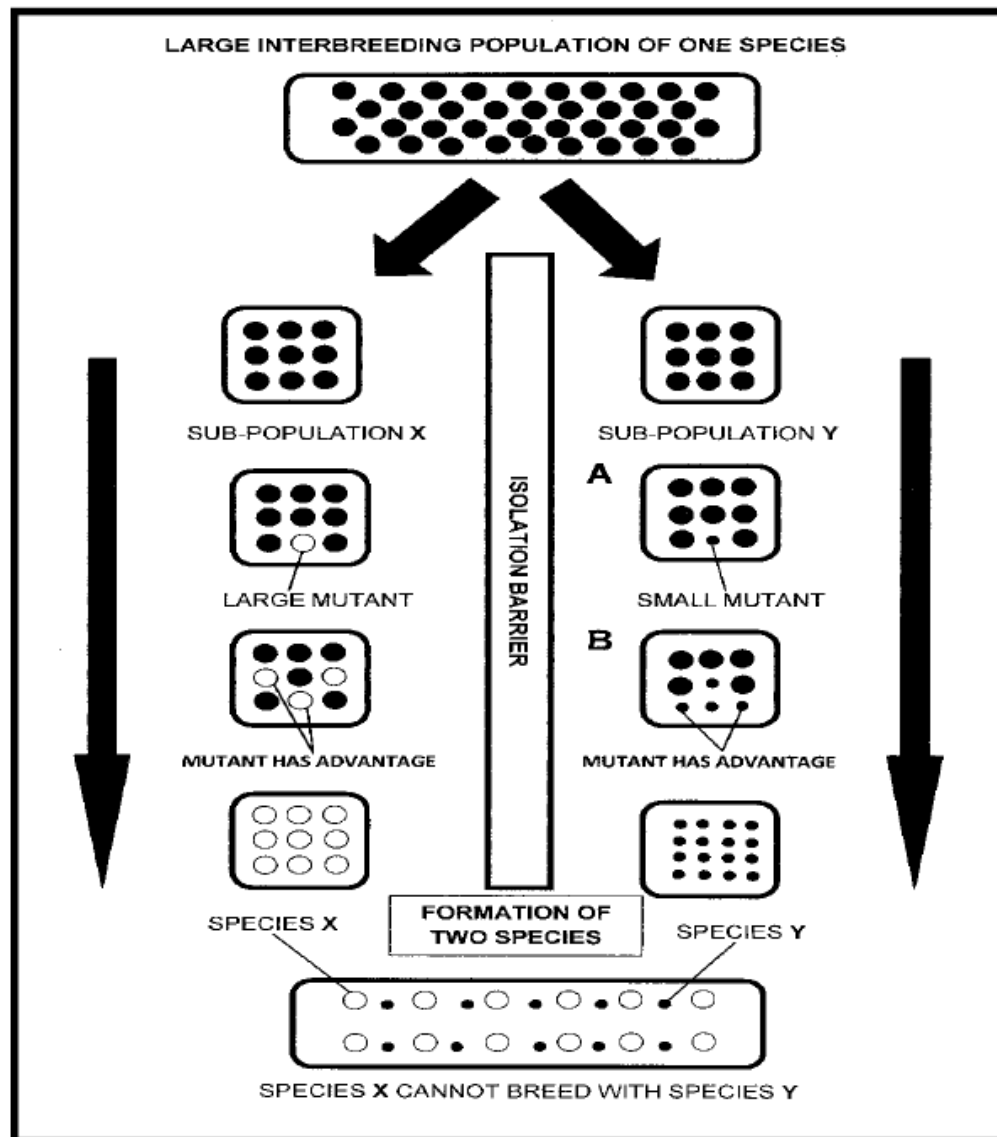


Describe how this kind of speciation could have taken place to form two different species.

(8)

ADAPTED BY MR S.J SILAULE

- 2.1 The diagram below represents the occurrence of speciation. Study the diagram carefully and answer questions that follow.

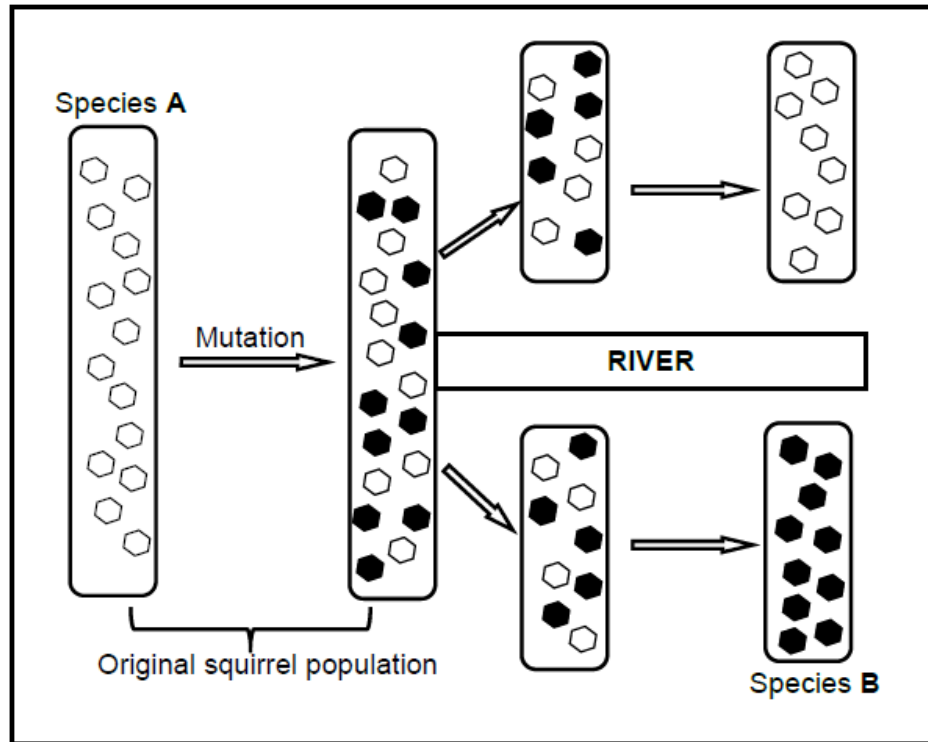


ADAPTED BY MR S.J SILAULE

- 2.1.1 Name the type of speciation represented in the above diagram. (1)
- 2.1.2 Name TWO examples of barriers which will have the same effect as shown in the diagram. (2)
- 2.1.3 Name the phenomenon that led to variation at **A**. (1)
- 2.1.4 Give THREE other causes of variation other than the one mentioned in QUESTION 2.1.3. (3)
- 2.1.5 What has happened at **B**? (1)
- 2.1.6 Define the term *species*. (3)

ADAPTED BY MR S.J SILAULE

- 2.2 A mutation occurred within a population of squirrels. This population was then separated by a river. Many years later it was discovered that the original population had undergone speciation. The process of speciation is shown in the diagram below.



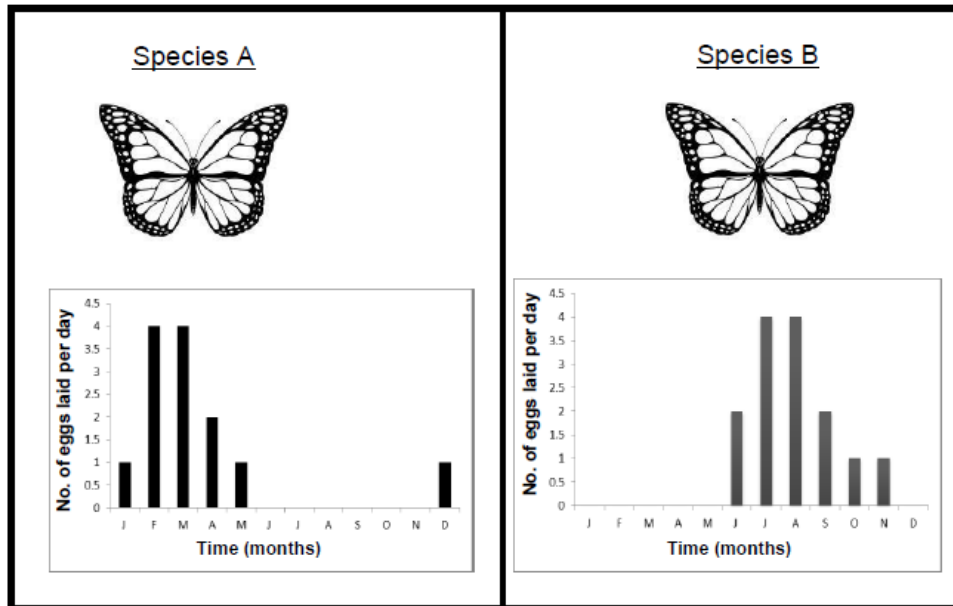
- 2.2.1 Define a *population*. (2)
- 2.2.2 Other than mutations, give THREE causes of variation in a population. (3)
- 2.2.3 Explain why there were eventually more squirrels with the mutation on one side of the river. (3)
- 2.2.4 Explain what effect the process above has on the biodiversity in this ecosystem. (2)
- 2.2.5 It was discovered that species **A** and **B** were TWO separate species.

Describe what can be done to confirm that the squirrels belong to two different biological species.

(2)
(12)

ADAPTED BY MR S.J SILAULE

- 3.2 The graphs below show the breeding seasons of two species of *Monarch* butterflies that are phenotypically identical, live in the same habitat and feed on nectar from flowers. Study the diagram and answer the questions that follow.



- 3.2.1 'Sometimes different but related species do interbreed.' Use the information provided to explain how the two species above are prevented from interbreeding. (2)
- 3.2.2 Name TWO reproductive isolating mechanisms other than the one mentioned in QUESTION 3.2.1. (2)
(4)

ADAPTED BY MR S.J SILAULE

6. Evolution in present times

3.1 Scientists investigated the resistance of mosquitos to DDT.

The following steps were followed:

- They captured a sample of mosquitos from the environment.
- The mosquitos were then exposed to a standard dose of DDT (4% DDT for 1 hour) in the laboratory.
- The number of mosquitos that died was counted.
- Those that survived were left to reproduce.
- A sample was taken from this population every two months and the same procedure was followed for a period of 16 months.

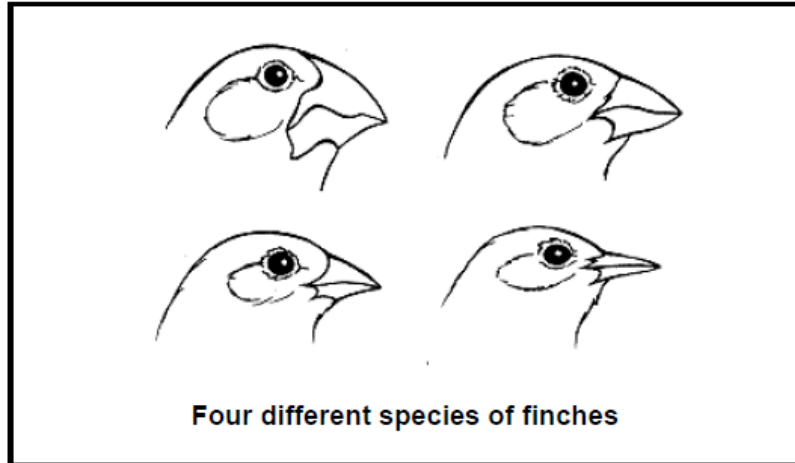
The results are shown in the table below.

TIME (IN MONTHS)	MORTALITY OF MOSQUITOES (%)
0	95
2	87
4	80
6	69
8	60
10	54
12	35
14	27
16	22

- 3.1.1 Identify the:
- (a) Independent variable (1)
- (b) Dependent variable (1)
- 3.1.2 Formulate a hypothesis for this investigation. (3)
- 3.1.3 Draw a line graph to show how the mortality of mosquitoes changed over the period of the investigation due to the application of DDT. (6)
- 3.1.4 State TWO factors, other than those mentioned, that should be controlled in this investigation. (2)
- 3.1.5 State TWO ways in which the scientists could improve the reliability of their results. (2)
- 3.1.6 Explain, in terms of natural selection, how mosquitoes may develop resistance to DDT. (8)
- (23)

ADAPTED BY MR S.J SILAULE

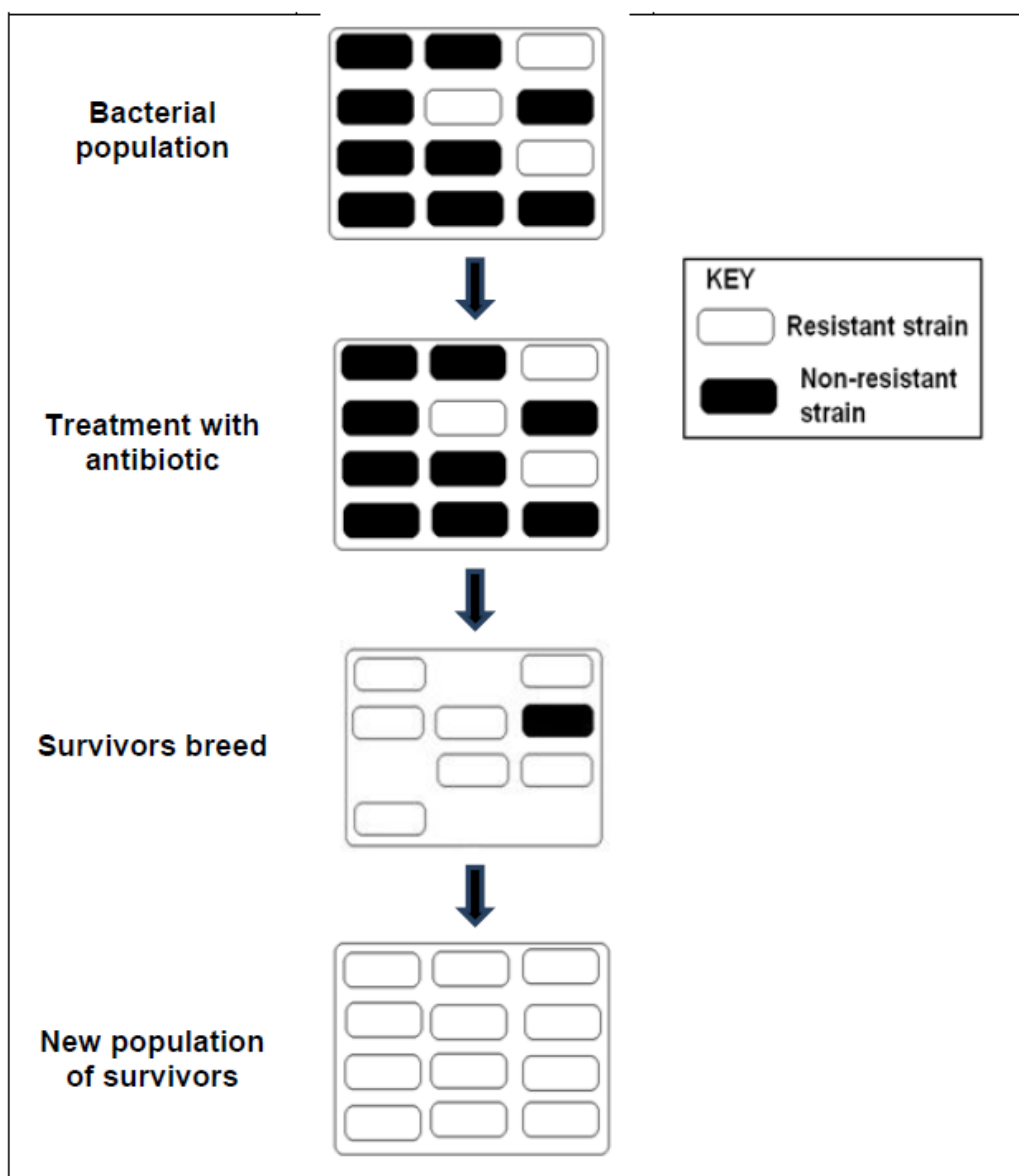
- 2.1 The diagrams below show the heads of four of the many species of finches inhabiting different islands in the Galapagos group, some 1 000 km from South America. The number of species of finches on the South American mainland is fewer than that found on the islands.



- 2.1.1 Explain ONE possible reason for the differences in the shape of the beaks. (2)
- 2.1.2 According to Darwin, these finches probably descended from a common ancestral finch species. Give a geological explanation of how this ancestor probably came to be on these islands. (2)
- 2.1.3 Describe how new finch species were formed on the different islands. (7)
- 2.1.4 Explain why there is a lower species diversity of finches on the South American mainland than on the islands. (3)
- (14)

ADAPTED BY MR S.J SILAULE

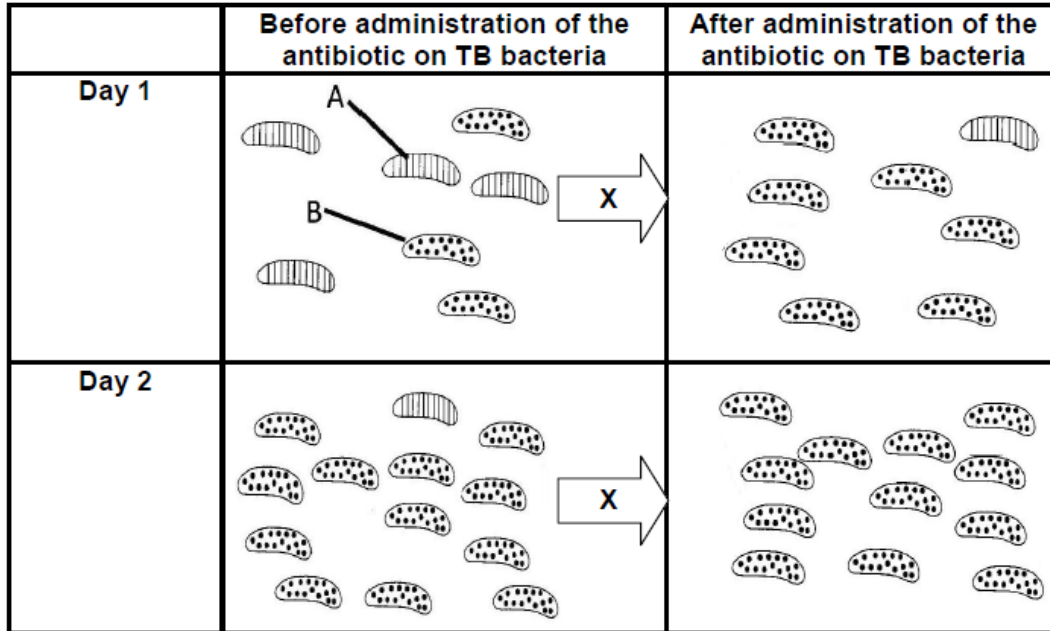
- 4.2 The result of a laboratory investigation shows the response of a bacterial population to the use of certain antibiotics. Study the diagrammatic presentation of the investigation and answer the following question.



Explain how the above sequences of diagrams show natural selection. (4)

ADAPTED BY MR S.J SILAULE

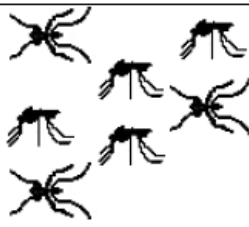
- 3.3 An investigation was carried out to determine the effect of an antibiotic on two types of bacteria (A and B) that cause TB. The diagram below shows the result of the antibiotic after Day 1 and Day 2 of a five day course to treat TB infection. The bacteria (strains A and B) were cultured in a petri dish at a temperature of 37,5° C.



- 3.3.1 Suggest ONE hypothesis for the above investigation. (3)
- 3.3.2 Which factors in the above investigation represent the
- independent variable? (1)
 - dependant variable? (1)
- 3.3.3 Which bacteria, **A** or **B**, is resistant to the antibiotic? (1)
- 3.3.4 Explain the effect that the antibiotic had on the bacteria after the first and second day of treatment. (2)
- 3.3.5 Name the process that leads to the difference in the population size of bacteria A and bacteria B. (1)
- 3.3.6 Predict the consequence should a person fail to complete the antibiotic course. (2)
- 3.3.7 Why must the bacteria be cultured at 37,5° C? (2)
- 3.3.8 State TWO precautions that must be taken to ensure that the results of the investigation are valid. (2)
- (15)**

ADAPTED BY MR S.J SILAULE

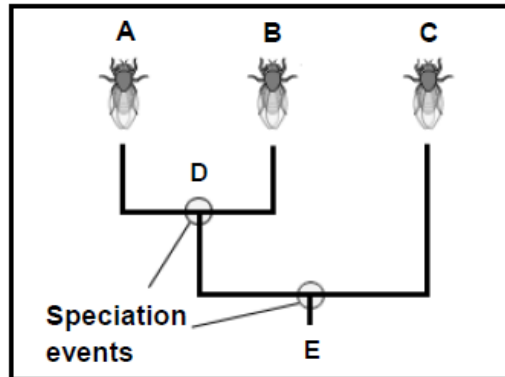
- 3.6 Study the following diagram showing the effect of DDT on a population of mosquitoes and answer the questions that follow.

	Before pesticide application	After pesticide application	Key
First generation		 Survivors of first pesticide application	Resistant mosquito 
Second generation		 Survivors of second pesticide application	Susceptible mosquitoes (affected by DDT) 

- 3.6.1 Describe the proportion of phenotypes of the first generation of mosquitoes:
- (a) Before pesticide application (1)
- (b) After pesticide application (1)
- 3.6.2 Explain the result of the first pesticide application. (2)
- 3.6.3 Why are there many mosquitoes that are more resistant in the second generation before pesticide application? (2)
- 3.6.4 Explain why there are no susceptible mosquitoes in the second generation after the pesticide was applied. (2)

ADAPTED BY MR S.J SILAULE

- 3.2 The phylogenetic tree below shows the evolution of three different species (A, B and C) of fruit fly.



[Adapted from: <http://evolution.berkeley.edu>]

- 3.2.1 Which letter represents the common ancestor of the three species of fruit fly? (1)
- 3.2.2 Which **TWO** species of fruit fly shown in the phylogenetic are most closely related? (1)
- 3.2.3 Name **TWO** reproductive isolating mechanisms that could have caused the speciation events. (2)
- 3.2.4 Describe how the evolution of these flies could be explained using punctuated equilibrium. (4)
(8)

ADAPTED BY MR S.J SILAULE

- 2.2 Study the table below that shows the change in antibiotic resistance in three strains of bacteria (MRSA, VRE and FQRP) over a period of 20 years.

YEAR	ANTIBIOTIC RESISTANCE (%)		
	MRSA	VRE	FQRP
1981	2	0	0
1985	10	0	0
1989	15	2	0
1993	40	5	5
1997	40	20	10
2001	60	20	25

[Source: <http://wallace.genetics.uga.edu/groups/evol>]

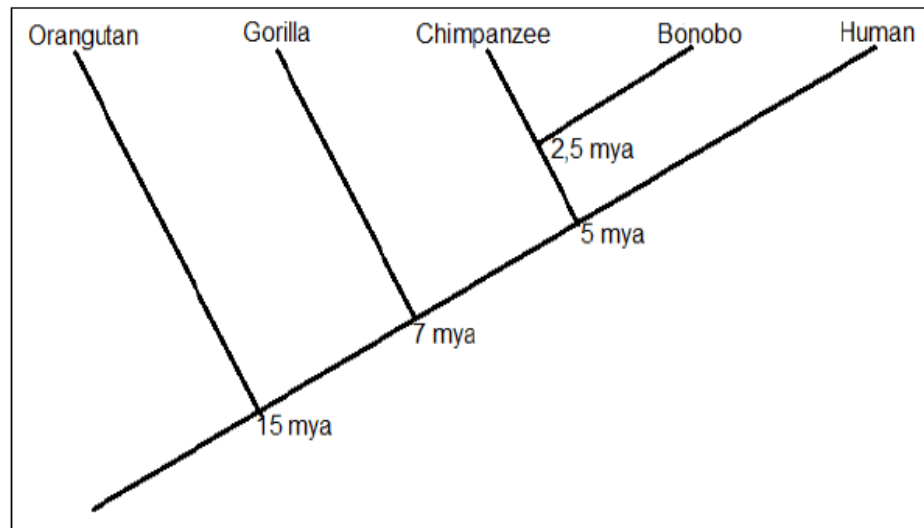
- 2.2.1 Which bacterial strain was the:
- (a) Most resistant to antibiotics over the years (1)
- (b) Last to develop antibiotic resistance (1)
- 2.2.2 Calculate the percentage increase in antibiotic resistance in VRE from 1993 to 1997. (3)
- 2.2.3 Draw a line graph to show the development of antibiotic resistance in the bacterial strain MRSA. (6)
- (11)

ADAPTED BY MR S.J SILAULE

7. Evidence of common ancestors for living hominids

7 Interpretation of a phylogenetic tree to show the place of the family Hominidae in the animal kingdom

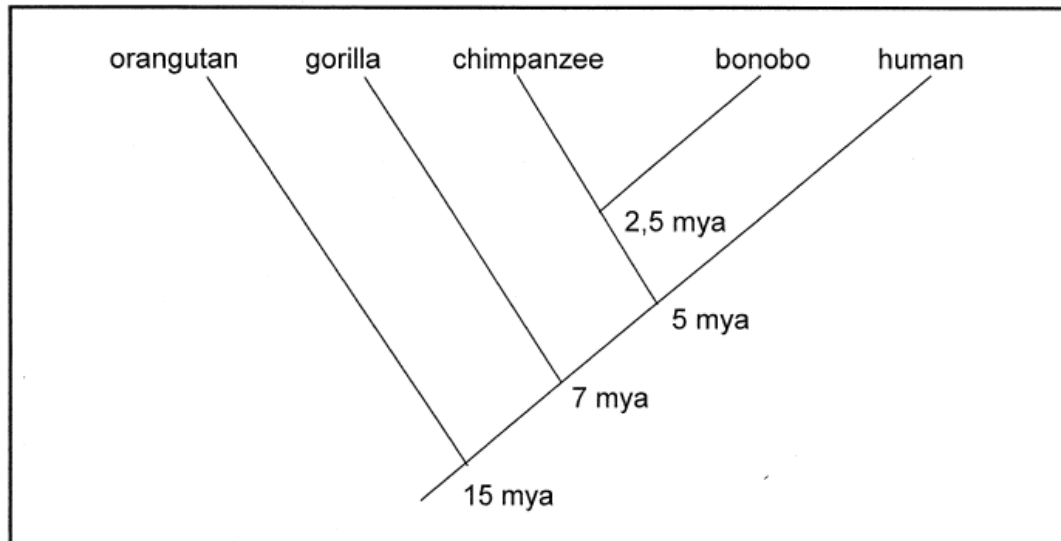
- 2.5 The diagram below shows a phylogenetic tree constructed after scientists analysed the mitochondrial DNA of humans and of the modern apes. Study the diagram and answer the questions that follow.



- 2.5.1 Which species is most closely related to chimpanzees? (1)
- 2.5.2 How long ago did the common ancestor of gorillas, chimpanzees and humans arise? (1)
- 2.5.3 Which species is most distantly related to humans? (1)
- 2.5.4 Explain why the following statement is NOT true: "Humans evolved from chimpanzees". (2)

ADAPTED BY MR S.J SILAULE

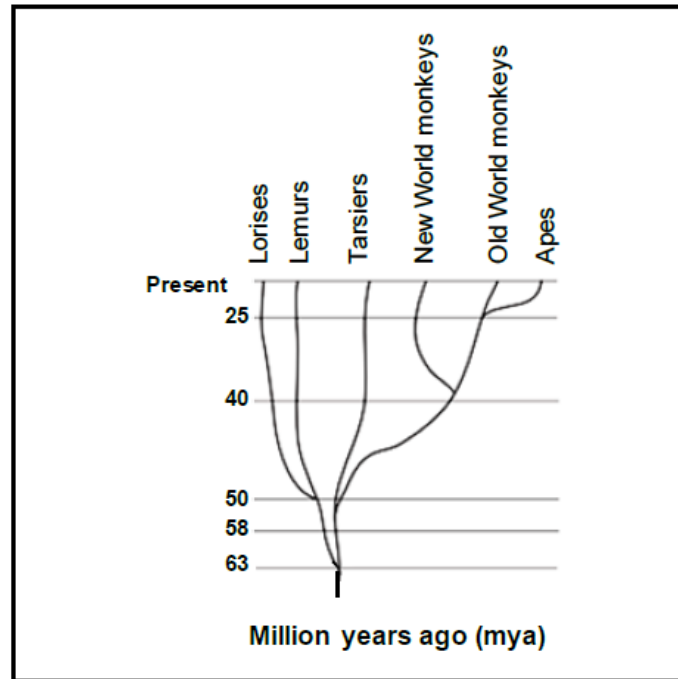
- 3.2 By analysing the DNA of humans and living apes, scientists have produced the phylogenetic tree below. Study the evolutionary relationship below and then answer the questions that follow.



- 3.2.1 When did gorillas first arise? (1)
- 3.2.2 When did the human line branch off from the chimpanzee? (1)
- 3.2.3 Which TWO organisms are most closely related? (2)
- (4)

ADAPTED BY MR S.J SILAULE

- 1.4 The diagram below shows possible evolutionary relationships among primates.

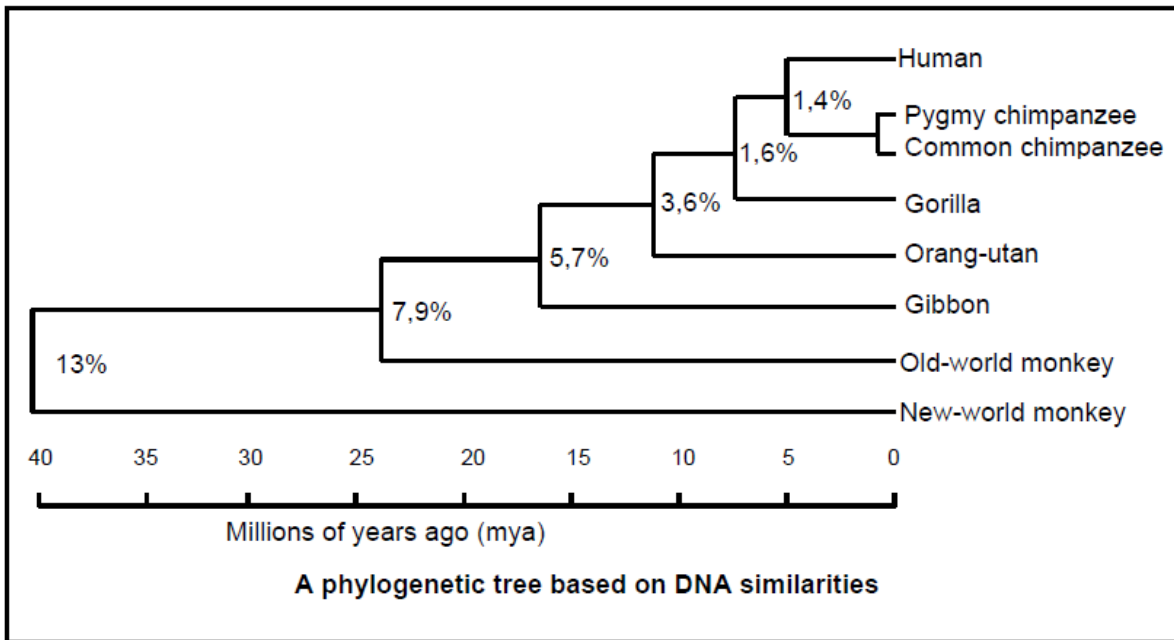


[Source: <http://dl0.creation.com/articles>]

- 1.4.1 How many million years ago did the:
- (a) Apes appear on Earth (1)
 - (b) Common ancestor evolve to form the Tarsiers and Lemurs (1)
- 1.4.2 Which TWO species share the most recent common ancestor? (2)
- 1.4.3 Which species is most closely related to the Lemur? (1)
- (5)

ADAPTED BY MR S.J SILAULE

- 1.4 The diagram below shows a phylogenetic tree based on DNA similarities. The percentage next to each branch shows the amount of difference in the genome (DNA nucleotide sequence) of the two relevant groups.

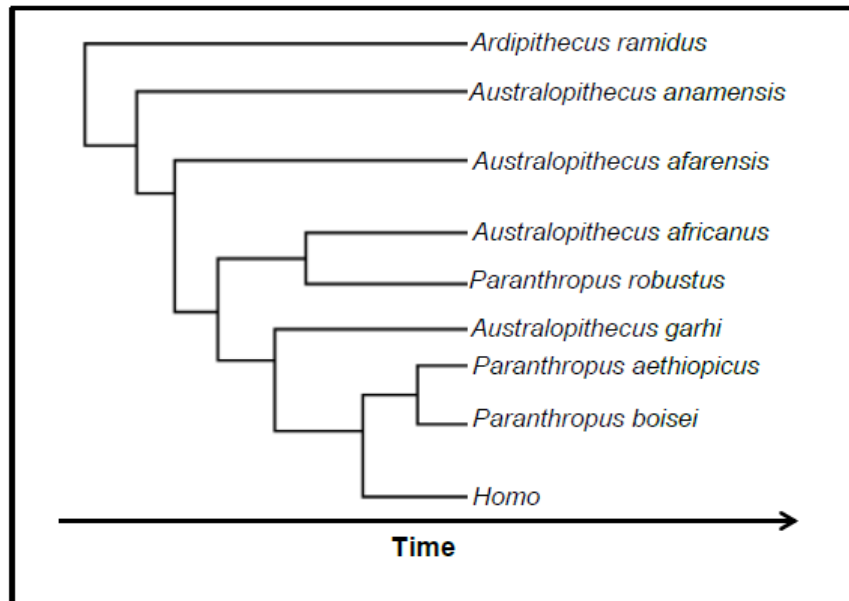


[Adapted from: *Senior Biology 2*]

- 1.4.1 From the diagram, determine how long ago the chimpanzees split from the line to humans. (2)
- 1.4.2 Which organism is most closely related to humans? (1)
- 1.4.3 Calculate the DNA similarity between the genome of the chimpanzee and the human. (2)

ADAPTED BY MR S.J SILAULE

- 2.5 The diagram below shows possible evolutionary relationships between hominids.

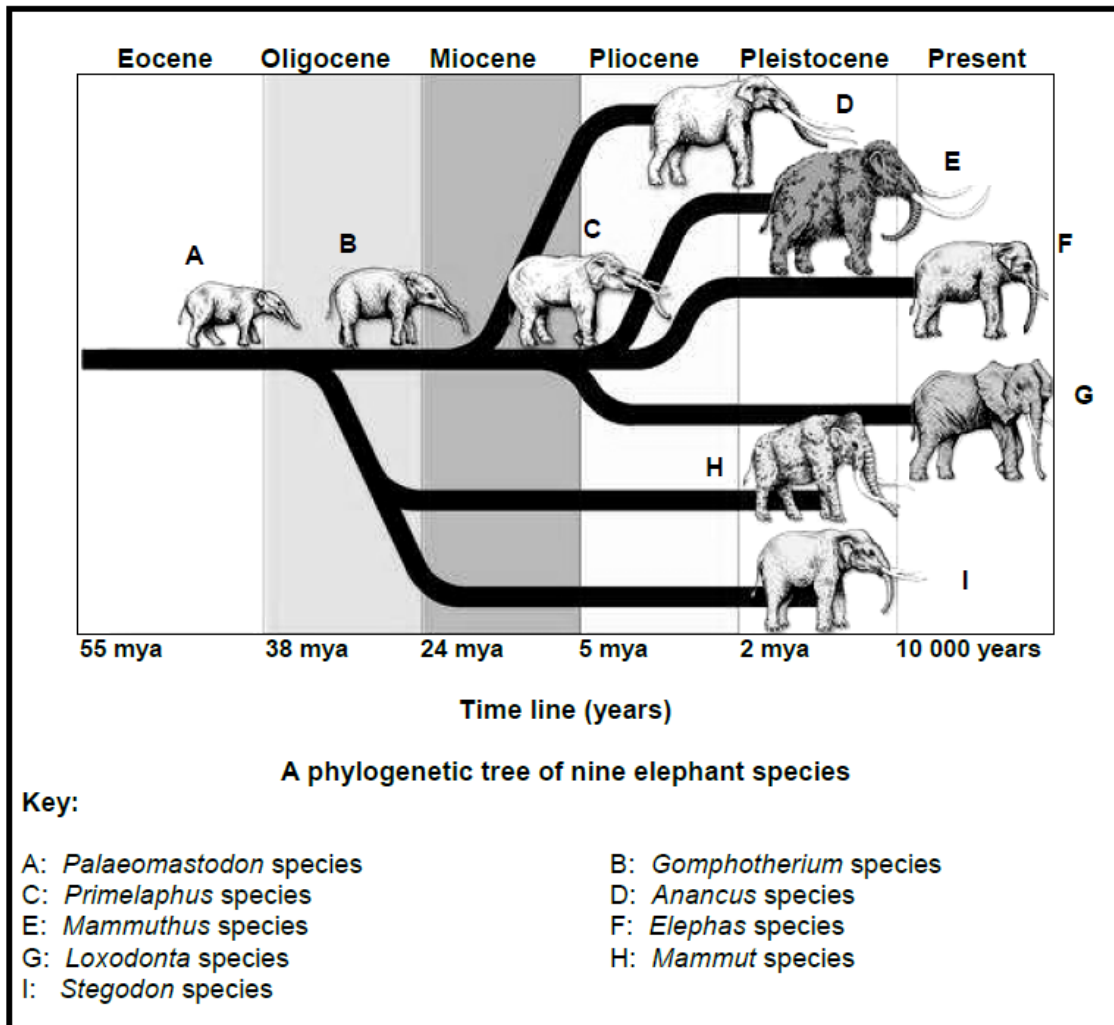


[Source: <http://tolweb.org/tree>]

- 2.5.1 What is this type of diagram called? (1)
- 2.5.2 How many genera are shown in the diagram above? (1)
- 2.5.3 According to this diagram, which:
- (a) Genus is most recently evolved (1)
 - (b) Genus is the oldest (1)
 - (c) Hominid share a common ancestor with *Australopithecus africanus* (1)
- 2.5.4 Give ONE example of an *Australopithecus africanus* fossil found in South Africa. (1)
- 2.5.5 Name TWO *Homo* species, besides *Homo sapiens*, that were found in Africa. (2)
- (8)**

ADAPTED BY MR S.J SILAULE

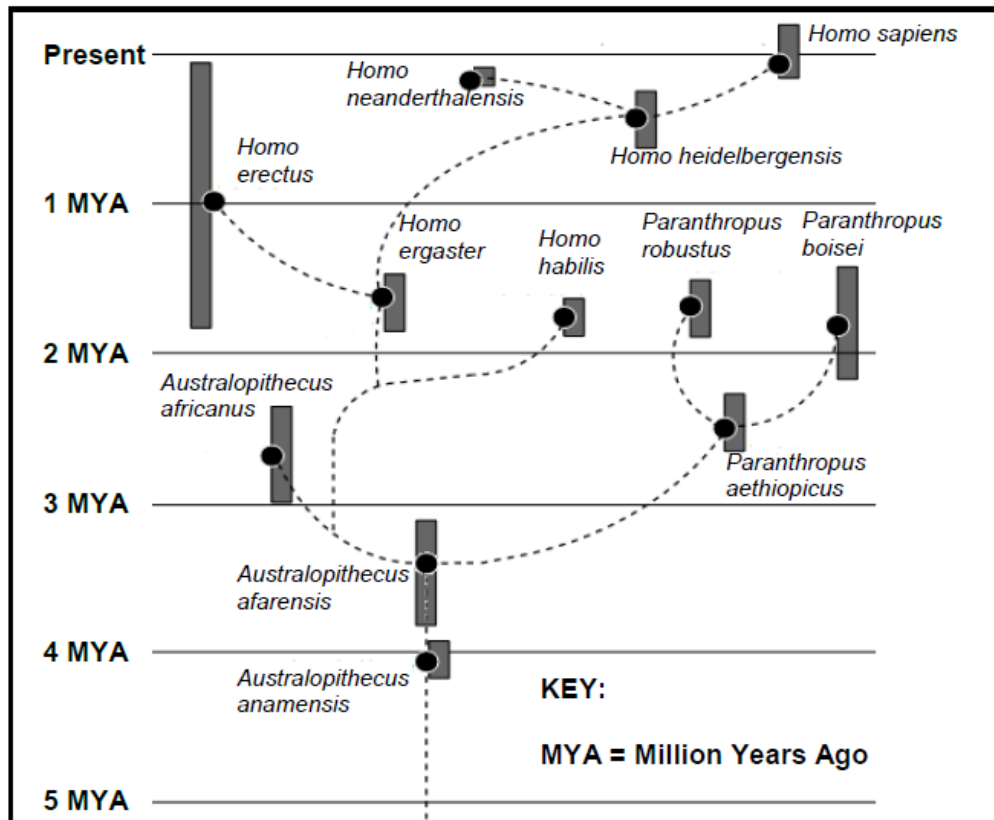
- 4.2 Study the phylogenetic tree of nine elephant species over six geologic time periods from 55 million years ago (mya) to the present and answer the questions below.



- 4.2.1 According to the phylogenetic tree above, which is the ancestral species of ALL the named species? (1)
- 4.2.2 Name the TWO species of elephants that exist today. (2)
- 4.2.3 Name the immediate ancestor of the two species mentioned in QUESTION 4.2.2. (1)
- 4.2.4 In which period did:
- The *Anancus* species first appear (1)
 - The *Stegodon* species become extinct (1)
- (6)

ADAPTED BY MR S.J SILAULE

- 2.2 The phylogenetic tree below shows one interpretation of the origin of humans. The dotted lines indicate the possible evolutionary relationships, and the vertical bars show the period during which the organisms are believed to have existed on earth.



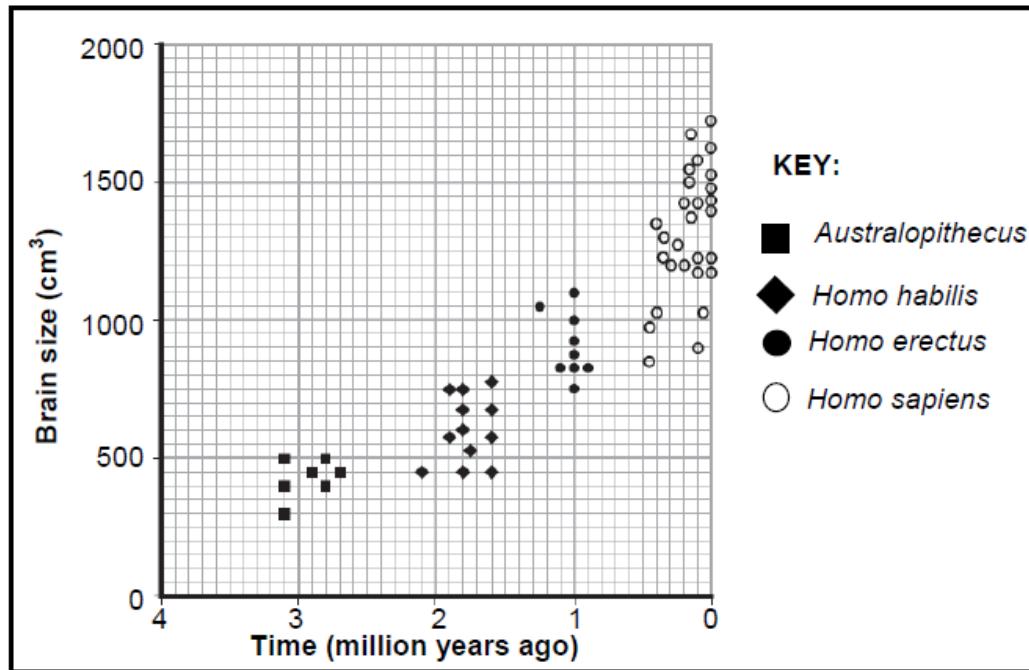
- 2.2.1 Use the diagram to identify ONE organism that may have competed with *Homo heidelbergensis* for resources. (1)
- 2.2.2 Identify the common ancestor that gave rise to both *Paranthropus* and *Homo*. (1)
- 2.2.3 (a) For what period of time did *A. africanus* exist on Earth? Show all working. (3)
- (b) Name ONE piece of evidence that could be used to prove that *A. africanus* existed during the time period calculated in QUESTION 2.2.3(a). (1)
- 2.2.4 (a) Which organism, *H. ergaster* or *H. neanderthalensis*, is more closely related to modern-day humans? (1)
- (b) Explain your answer to QUESTION 2.2.4(a) using information in the diagram. (2)
- (9)

ADAPTED BY MR S.J SILAULE

- 1.5 Scientists estimated the brain sizes of *Australopithecus*, *Homo habilis*, *Homo erectus* and *Homo sapiens* by using the cranial capacity of fossil specimens. They then compared their results to the time that each hominid existed on earth.

The graph below represents the range of brain size and the time period that the hominid existed according to fossil evidence.

The results of the investigation are shown on the graph below.

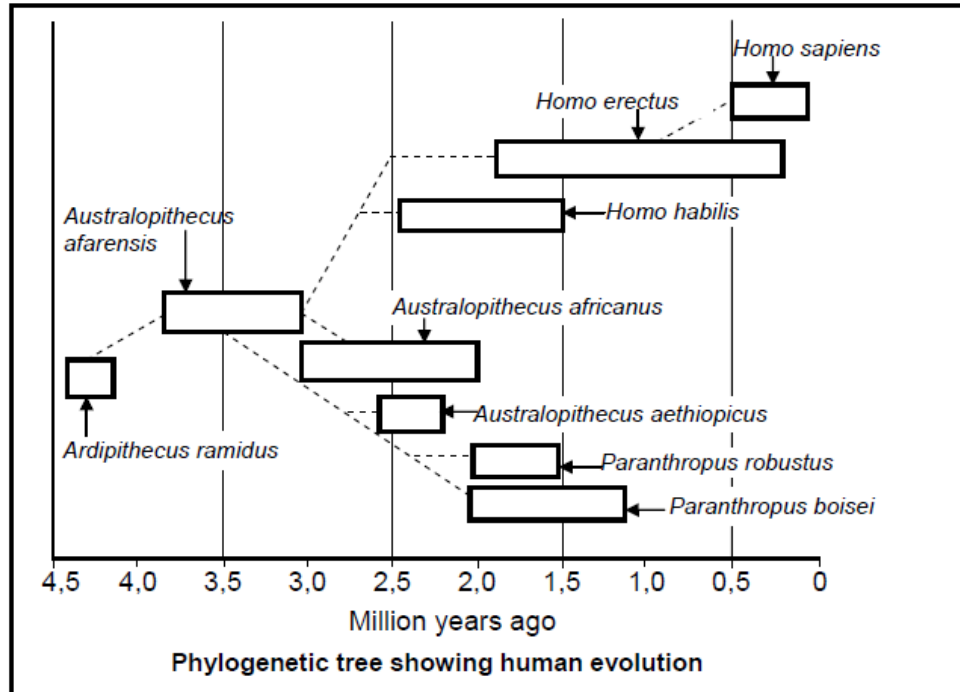


[Adapted from AQA-BLY1B-W-QP-NOV07 Unit 1b]

- 1.5.1 According to the graph:
- When did the first *Australopithecus* appear (2)
 - Which of the species shows the greatest variation in brain size (1)
- 1.5.2 Give the size (in cm³) of the:
- Largest brain of *Australopithecus* (1)
 - Smallest brain of *Homo sapiens* (1)
- 1.5.3 State TWO types of evidence, other than fossils, that support the idea that all hominids evolved from a common ancestor. (2)
(7)

ADAPTED BY MR S.J SILAULE

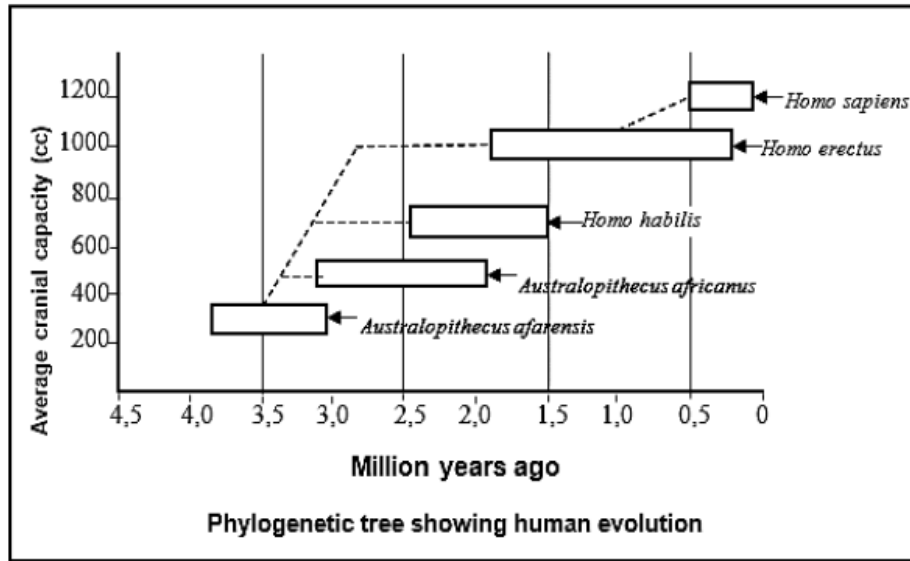
- 2.3 Study the phylogenetic tree below showing a possible representation of human evolution and answer the questions which follow.



- 2.3.1 According to the phylogenetic tree, which organism, *Paranthropus boisei* or *Homo habilis*, appeared first on Earth? (1)
- 2.3.2 Name TWO species whose existence on Earth overlapped with that of *Homo erectus*. (2)
- 2.3.3 Which organism was the direct ancestor of *Homo habilis*? (1)
- 2.3.4 List FIVE characteristics that are shared by all the organisms in the above phylogenetic tree. (5)
- 2.3.5 How long did *Australopithecus africanus* exist on Earth? (1)
- (10)

ADAPTED BY MR S.J SILAULE

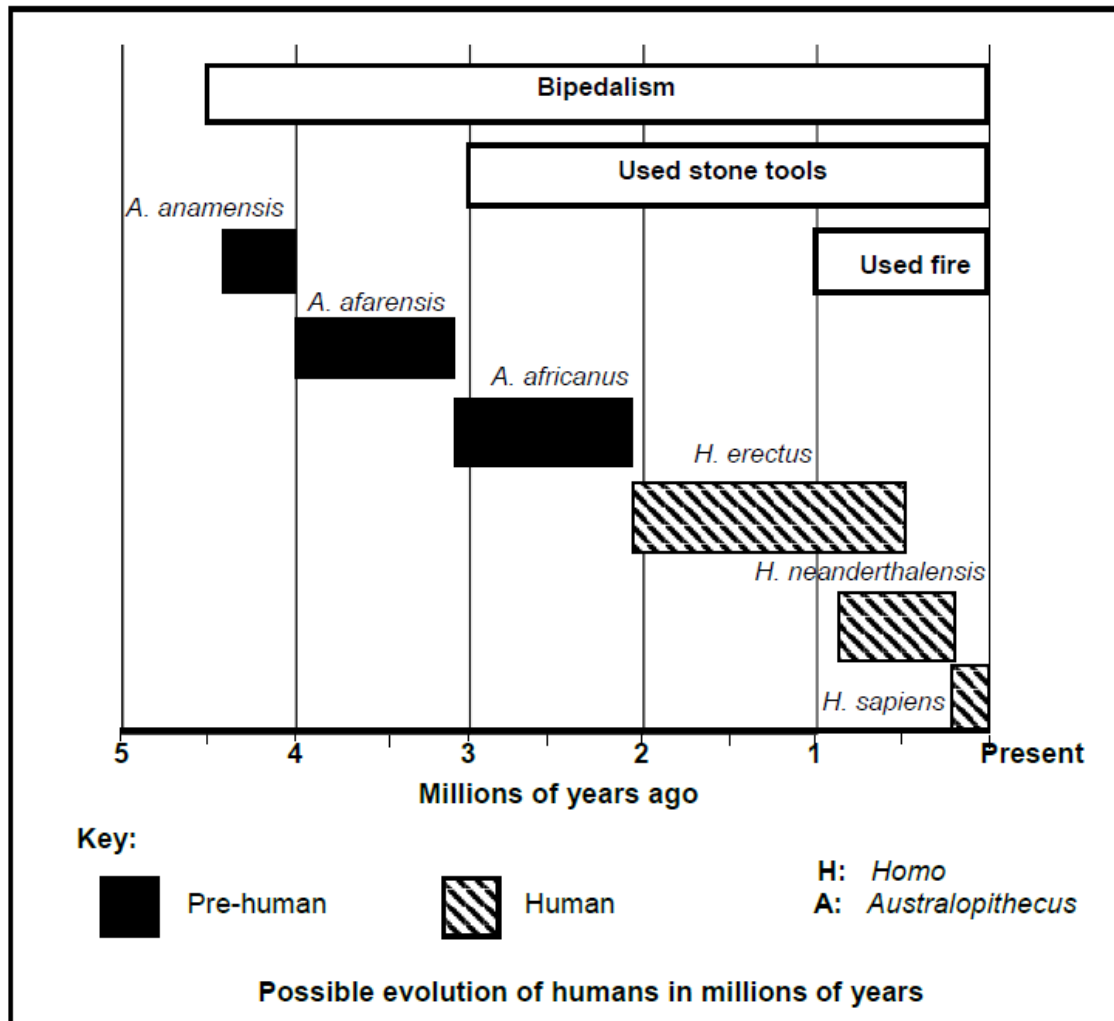
1.4 Study the phylogenetic tree below and answer the questions that follow.



- 1.4.1 Define a *phylogenetic tree*. (2)
- 1.4.2 Which organism is considered to be the common ancestor? (1)
- 1.4.3 Which organism has the biggest cranial capacity? (1)
- 1.4.4 Name TWO species that lived between 1,5 and 2 million years ago. (2)
- 1.4.5 Calculate the time difference between the evolution of *Homo erectus* and *Homo sapiens*. (Show your working.) (3)
- 1.4.6 Which organism – *Homo erectus* or *Homo habilis* – is more closely related to modern day humans? (1)

ADAPTED BY MR S.J SILAULE

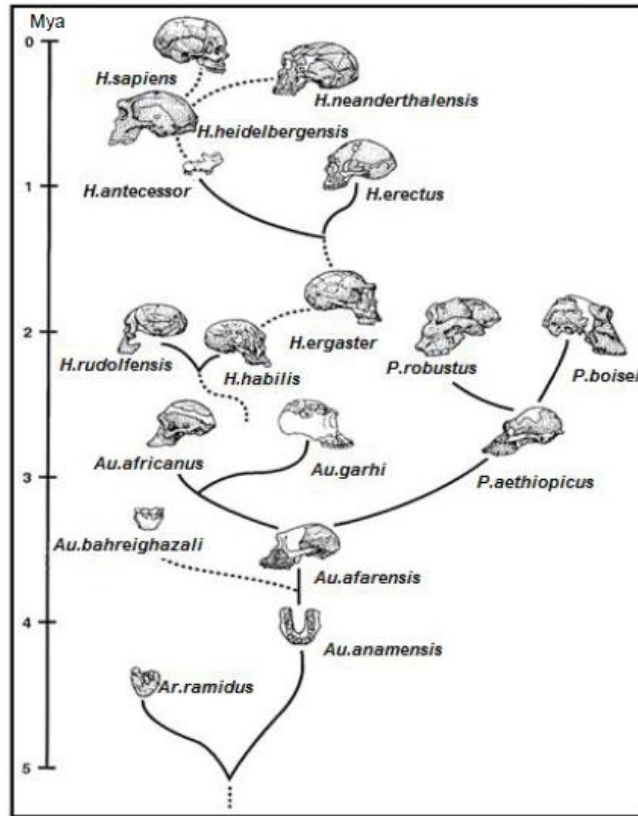
- 3.4 The diagram below represents the possible evolution of humans, as well as the time period for the development of bipedalism, the use of fire and the use of tools.



- 3.4.1 Use the diagram above and identify TWO bipedal organisms that did not use stone tools or fire. (2)
- 3.4.2 How long after developing the ability to walk on two feet did pre-humans develop the ability to use stone tools? Show ALL working. (3)
- 3.4.3 Explain the significance of the characteristic of the skull which allowed for the development of the ability to use tools in the *Homo* species. (2)
- 3.4.4 Explain the relationship between the use of fire and changes in dentition in the *Homo* species. (2)
- (9)

ADAPTED BY MR S.J SILAULE

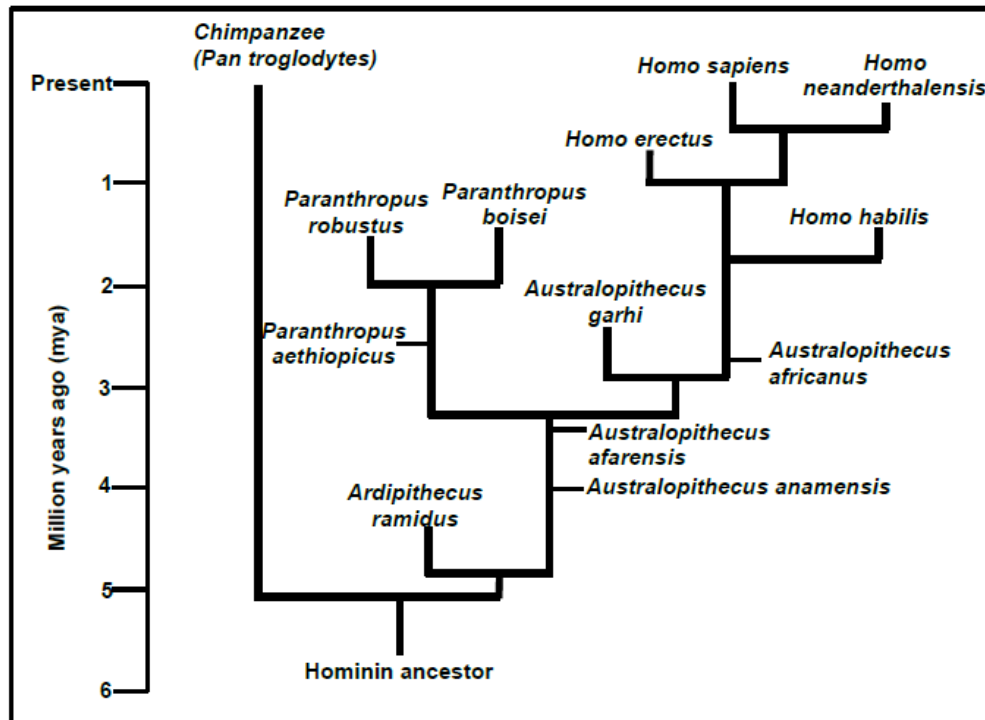
- 3.4. Study the phylogenetic tree below on brain capacity of hominid species and answer the questions that follow.



- 3.4.1 Identify the THREE main genera of the hominid species shown in the above illustration. (3)
- 3.4.2 Using the phylogenetic tree, name the common ancestor of *H. sapiens* and *H. neanderthalensis* (1)

ADAPTED BY MR S.J SILAULE

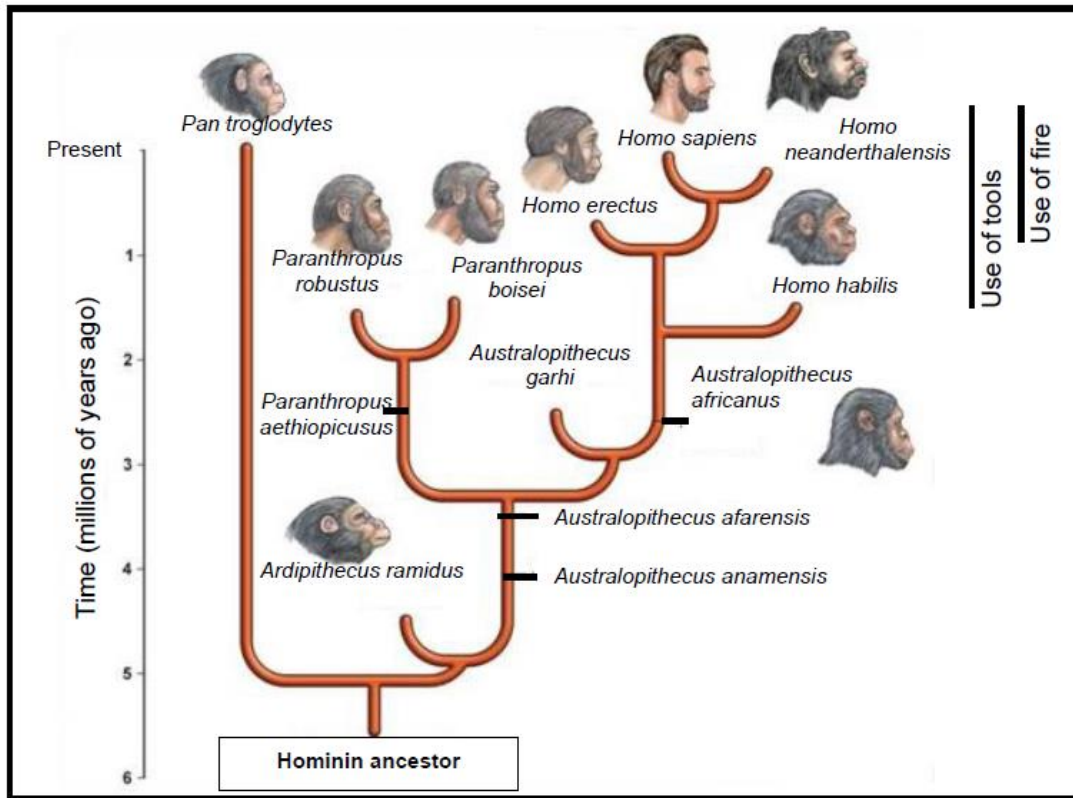
- 1.5 The diagram below shows possible evolutionary relationships among some hominids.



- 1.5.1 What is this type of diagram called? (1)
- 1.5.2 How many of EACH of the following are represented in the diagram:
- (a) Genera (1)
 - (b) *Homo* species (1)
- 1.5.3 Name the species that have *Paranthropus aethiopicus* as a common ancestor. (2)
- 1.5.4 When did:
- (a) *Ardipithecus ramidus* become extinct (1)
 - (b) *Homo erectus* first appear (1)
- 1.5.5 Name the:
- (a) Hominid species that existed at the same time as *Homo sapiens* (1)
 - (b) First *Homo* species to use tools (1)
- (9)**

ADAPTED BY MR S.J SILAULE

1.4 The phylogenetic tree below shows a possible representation of human evolution.



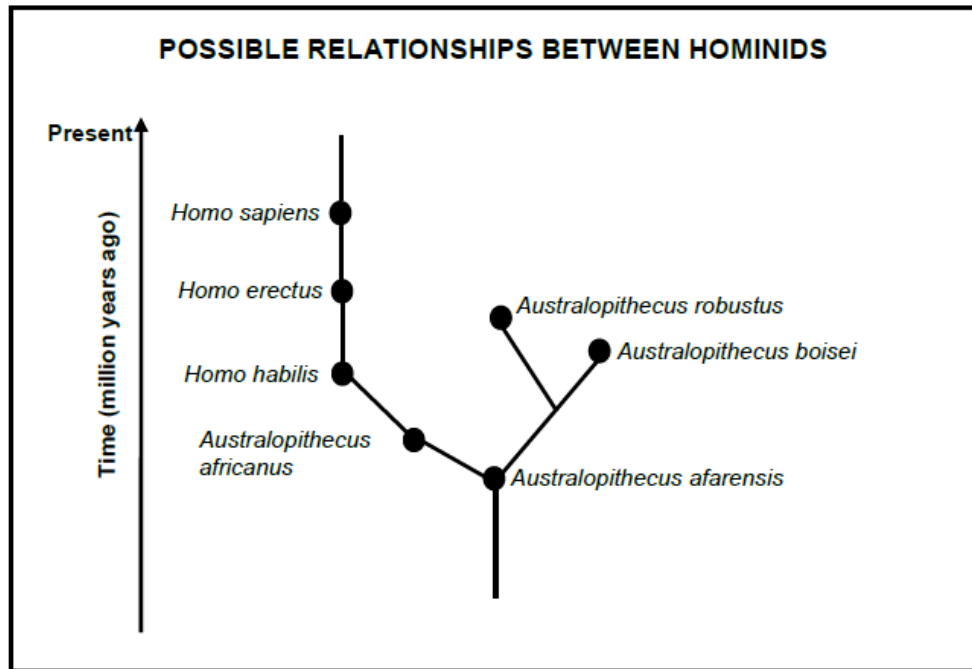
[Adapted from: www.humanevolutionofficial.weebly.com]

- 1.4.1 Name the most recent common ancestor of the *Homo* genus. (1)
- 1.4.2 Give the period of existence for the species mentioned in QUESTION 1.4.1 (2)
- 1.4.3 State the number of genera represented in the diagram. (1)
- 1.4.4 Based on the diagram, give ONE facial feature that differentiated humans from *Australopithecus africanus*. (1)
- 1.4.5 Identify any TWO species that used both tools and fire. (2)
- 1.4.6 Name any ONE *Australopithecus africanus* fossil found in South Africa. (1)
- 1.4.7 List TWO types of evidence that can be used to support the "Out of Africa" hypothesis. (2)

(10)

ADAPTED BY MR S.J SILAULE

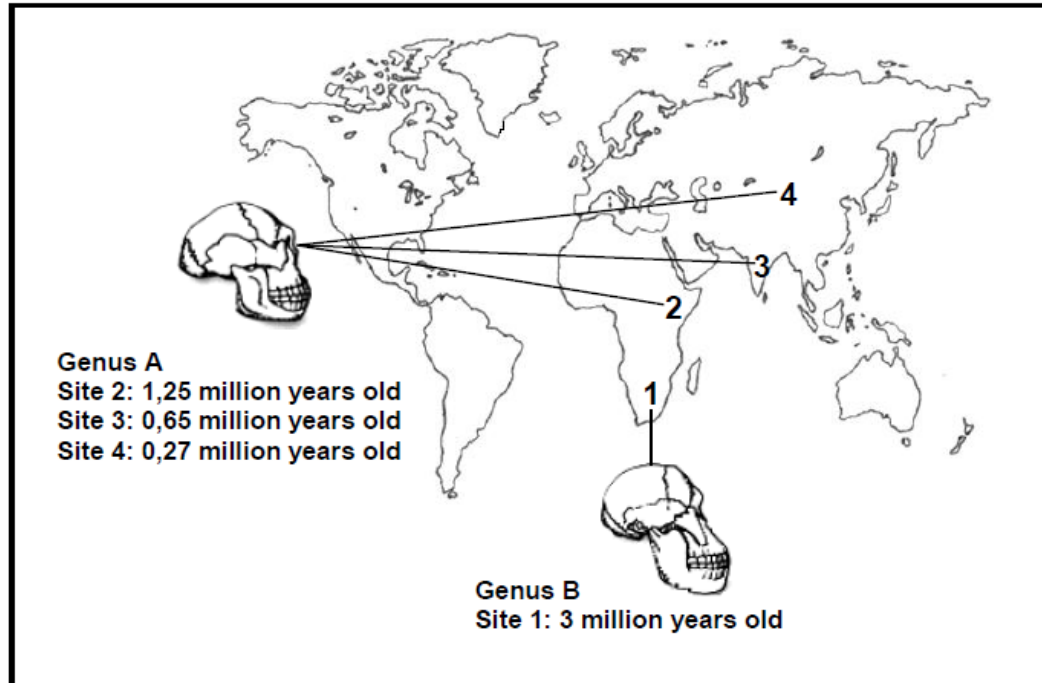
- 3.2 The diagram below shows possible relationships between members of the family *Hominidae*.



- 3.2.1 What is the name given to the type of diagram above? (1)
- 3.2.2 How many of each of the following are represented in the diagram?
- (a) Genera (1)
- (b) Species (1)
- 3.2.3 Explain why *A. robustus* and *A. boisei* are more closely related than *A. boisei* and *A. afarensis*. (2)
- 3.2.4 Which of the hominids in the diagram above is considered to have been the first to use tools? (1)
- 3.2.5 Name TWO *Australopithecus* fossils found in South Africa. (2)
- 3.2.6 Explain how the location and the age of *Homo* fossils are used as evidence for the 'Out of Africa' hypothesis. (3)
- (11)**

ADAPTED BY MR S.J SILAULE

- 1.4 The diagram below shows a world map indicating four sites (1 to 4) where hominid fossils, representing two different genera, have been found. Genus **A** was found at three sites and genus **B** at one site. The age of each fossil was determined using radiometric dating.

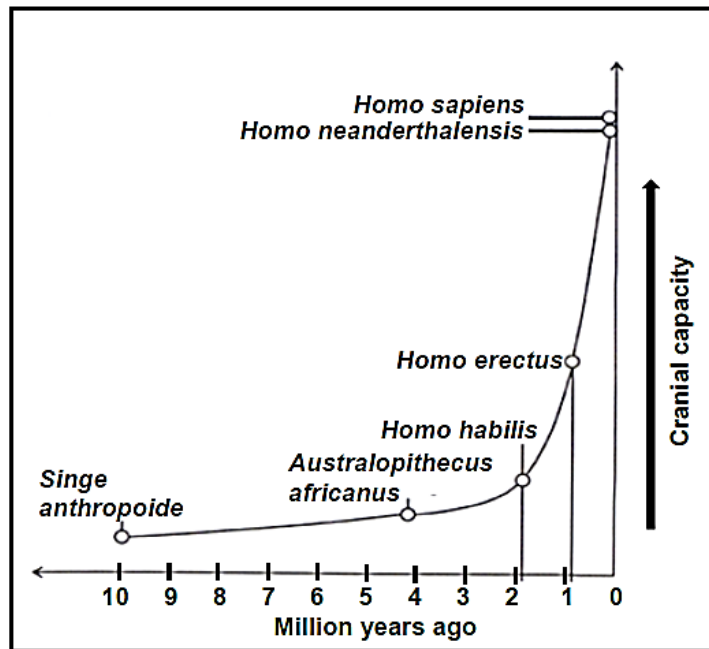


[Adapted from www.biologyreference.com]

- 1.4.1 Which genus (**A** or **B**):
- (a) Represents *Australopithecus* (1)
 - (b) Had a more prognathous skull (1)
 - (c) Had smaller canines (1)
 - (d) Is more closely related to *Homo sapiens* (1)
- 1.4.2 Name TWO examples of fossils of genus **B** found at site 1 in South Africa. (2)
- 1.4.3 At which site, 1 to 4, were the youngest fossils found? (1)
- 1.4.4 Other than fossil evidence, what other evidence can be used to support the Out of Africa hypothesis? (1)
- (8)

ADAPTED BY MR S.J SILAULE

- 3.3 The graph below shows the time of existence and cranial capacity of various primate species.



- 3.3.1 Name the *Homo* species which:
- (a) Was the first to migrate out of Africa (1)
 - (b) Is known to be the first to use tools (1)
- 3.3.2 How many million years ago did *Australopithecus africanus* appear on Earth? (1)
- 3.3.3 Name ONE type of evidence that could be used to prove that *Australopithecus africanus* came about at the time mentioned in QUESTION 3.3.2. (1)
- 3.3.4 One of the fossils of *Australopithecus africanus* is Taung child.
- (a) Name the scientist who discovered Taung child. (1)
 - (b) Where was Taung child discovered? (1)
- 3.3.5 Based on the diagram give TWO visible differences in the skulls of *Australopithecus* and *Homo sapiens sapiens*. (4)
- 3.3.6 Using data from the graph describe the change in cranial capacity from 2 million years ago to the present time. (1)

ADAPTED BY MR S.J SILAULE

3.1 The following two questions refer to the characteristics of *Homo sapiens* and other primates.

3.1.1 State FOUR structural characteristics of *Homo sapiens* that are similar to other primates. (4)

3.1.2 Tabulate FOUR structural differences between the skull of *Homo sapiens* and that of other primates. (9)

4.1 *Homo sapiens* share some characteristics with other primates, one of which is an opposable thumb.

4.1.1 State ONE possible advantage of having an opposable thumb. (1)

4.1.2 List FOUR characteristics that humans share with primates, other than an opposable thumb. (4)
(5)

3.4 The following are some examples of evolutionary trends in different stages of human evolution. In these trends the following characteristics were identified:

- Opposable thumb
- Small brain
- Prognathous face
- Bipedal
- Smaller canines
- Projecting nose
- Small body size

[Adapted from: *Ape Human*, National Geographic, Aug 2011]

3.4.1 List FOUR characteristics from the list above that are similar to that of *Australopithecus africanus*. (4)

3.4.2 State TWO advantages of having an opposable thumb. (2)

3.4.3 Explain why Professor Berger called Karabo a transitional fossil. (2)
(8)

ADAPTED BY MR S.J SILAULE

2.1 Read the passage below.

NEW HOMININ SPECIES DISCOVERED

On 13 September 2013 scientists discovered fossils in the Sterkfontein Caves in South Africa which appeared to belong to a previously unknown species of hominins.

The fossils were classified as a new species, *Homo naledi*. The physical characteristics of *H. naledi* are described as having traits similar to the genus *Australopithecus*, mixed with traits more characteristic of the genus *Homo*. It appeared that *H. naledi* represented a transitional fossil.

An analysis of *H. naledi*'s skeleton suggests that it stood upright and was bipedal. The structure of the pelvis is similar to the *Australopithecines*, but its legs, feet and ankles are more similar to the genus *Homo*.

Four skulls were discovered, each with approximately half the volume of modern human skulls. The *H. naledi* skulls are closer in cranial volume to the skull of *Australopithecus*, but the cranium structure is more similar to those found in the genus *Homo*.

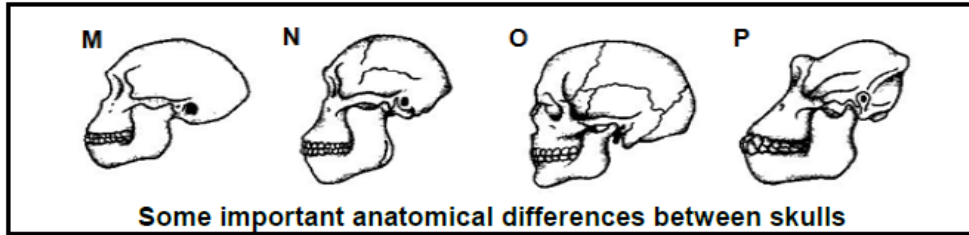
The teeth are much smaller than those of *Australopithecus* and similar to the teeth of modern humans.

[Adapted from <https://humanorigins.si.edu/evidence>]

- 2.1.1 Define the term *transitional fossil*. (2)
- 2.1.2 Name a characteristic from the passage that *Homo naledi* shared with both *Australopithecus* and *Homo*. (1)
- 2.1.3 State ONE other characteristic from the passage that *Homo naledi* shared only with *Australopithecus*. (1)
- 2.1.4 Explain TWO characteristics of a skeleton which are adaptations for bipedalism. (4)
- 2.1.5 Give ONE possible reason why there was a change to smaller teeth in modern humans. (3)
- (11)

ADAPTED BY MR S.J SILAULE

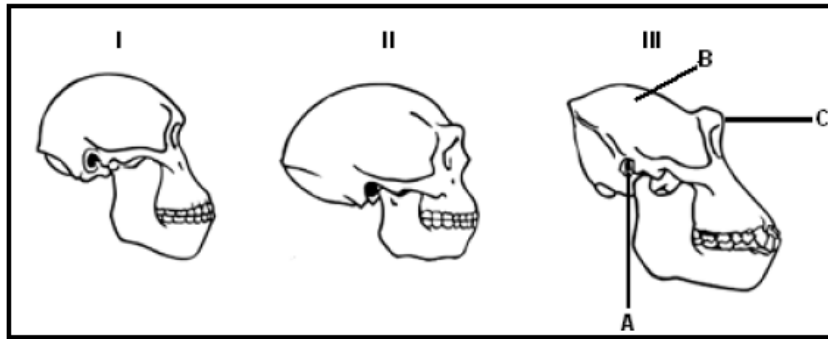
- 1.6 A comparison of the anatomical features of the skulls of different species has helped scientists to propose evolutionary relationships.



- 1.6.1 Tabulate THREE observable differences between the side view of the skulls **O** and **P**. (7)
- 1.6.2 Using the letters **M**, **N** and **O** from the diagram above, give the correct sequence in which these organisms appeared on Earth. (3)
- 1.6.3 Name ONE fossil of *Australopithecus* found in South Africa. (1)
- (11)**

ADAPTED BY MR S.J SILAULE

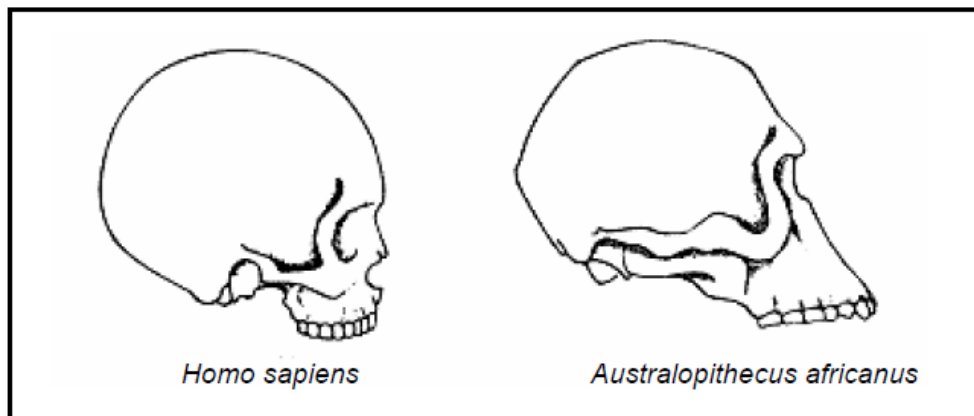
- 1.4 The diagram below shows the skulls of three primate genera and is NOT drawn to scale.



- 1.4.1 Name parts **B** and **C** respectively. (2)
- 1.4.2 Name the type of teeth that is larger in genus **III** compared to that of genera **I** and **II**. (1)
- 1.4.3 Give only the NUMBER(S) (**I**, **II** or **III**) of the skull(s) that:
- (a) Most likely belongs to a bipedal primate (2)
 - (b) Has the largest brain size (1)
 - (c) Is attached to a C-shaped vertebral column (1)
 - (d) Is most prognathous (1)
- 1.4.4 Give only the LETTER of the structure that is more pronounced in organism **III** than in organisms **I** and **II**. (1)
- 1.4.5 Give the correct sequence of the organisms (**I**, **II** and **III**), from most primitive to most evolved. (2)
- (11)**

ADAPTED BY MR S.J SILAULE

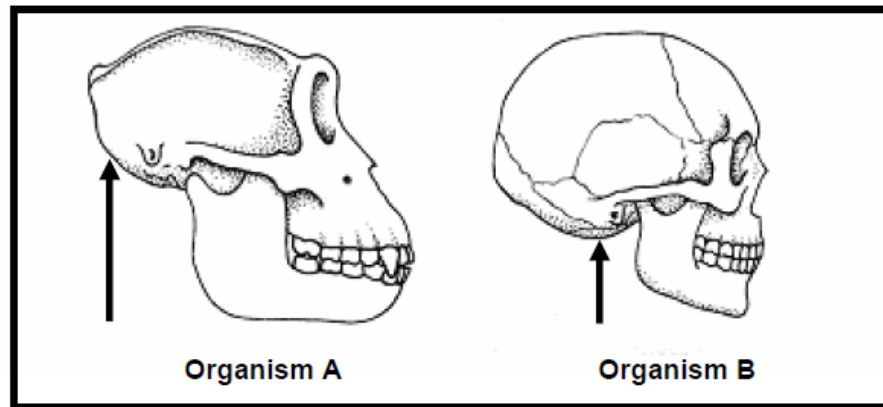
- 4.2 Study the two skulls below (drawn to the same scale) and answer the questions that follow.



- 4.2.1 Tabulate THREE visible differences from the two skulls shown above that scientists have used to differentiate between *Homo sapiens* and other primates. (7)
- 4.2.2 Give THREE examples of fossils of *Australopithecus* that were discovered in Southern Africa. (3)
- 4.2.3 Explain the importance of the discoveries of the skulls of *Australopithecus* in understanding the evolutionary development of humans. (2)

ADAPTED BY MR S.J SILAULE

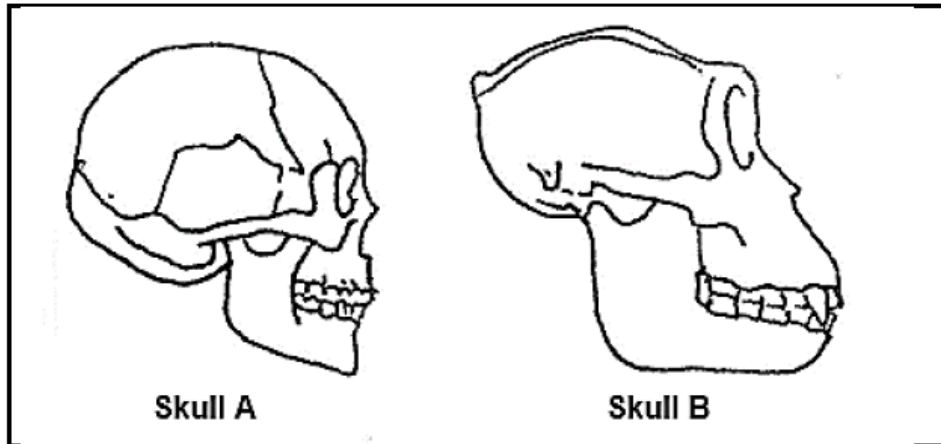
- 3.2 The diagrams below represent the skulls of two organisms, namely a modern human and a gorilla. Each arrow indicates the position of the foramen magnum. Study the diagrams and answer the questions that follow.



- 3.2.1 Identify each of the organisms that are represented by **A** and **B**. (2)
- 3.2.2 Tabulate **FOUR** observable differences between the skulls of organisms **A** and **B**. (9)
- 3.2.3 Which organism is bipedal for most of its adult life? (1)
- 3.2.4 Explain **TWO** possible advantages of bipedalism to the organism referred to in QUESTION 3.2.3. (4)
- 3.2.5 Name any **TWO** similarities between organisms **A** and **B**. (2)
- (18)**

ADAPTED BY MR S.J SILAULE

3.3 Study the two skulls below and answer the questions that follow.



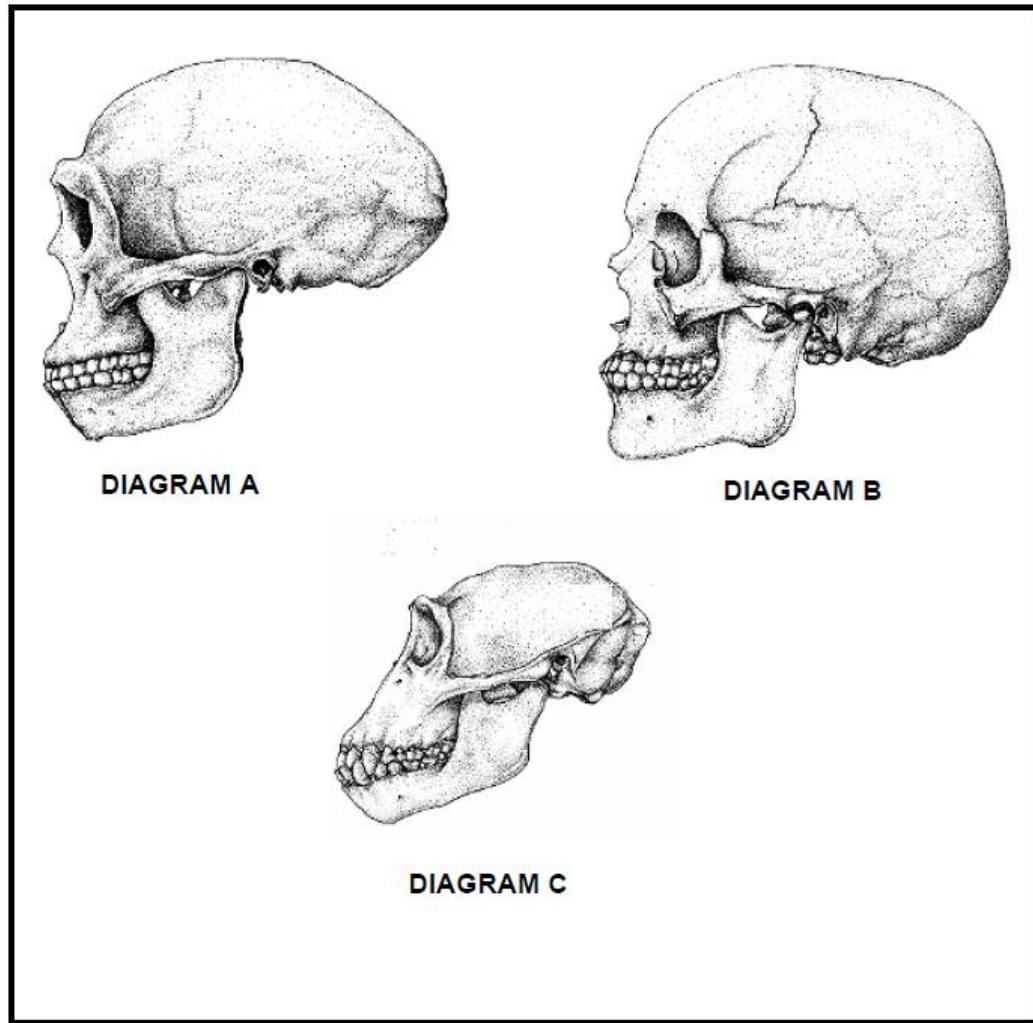
3.3.1 Which skull (A or B) is that of a non-human primate? (1)

3.3.2 List FIVE observable features/reasons for your answer in QUESTION 3.3.1. (5)

3.4 List THREE advantages of bipedalism. (3)

ADAPTED BY MR S.J SILAULE

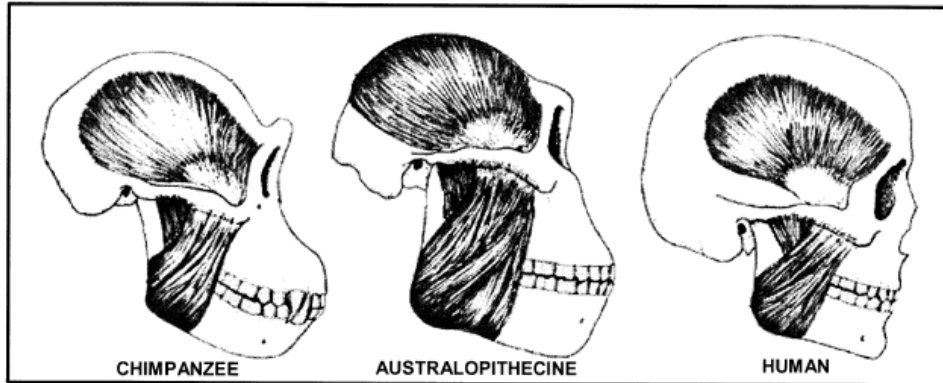
- 3.1 DIAGRAMS **A**, **B** and **C** below illustrate the skulls of *Homo sapiens*, *Homo erectus* and *Pan troglodytes* (chimpanzee). The diagrams are drawn to scale.



- 3.1.1 From the DIAGRAMS (**A**, **B** and **C**), name the species that appeared on Earth as follows:
- (a) First
 - (b) Second
 - (c) Last
- (3)
- 3.1.2 Tabulate THREE visible structural differences between DIAGRAM A and DIAGRAM B that illustrate evolutionary trends in human development.
- (7)
(10)

ADAPTED BY MR S.J SILAULE

- 3.1 Study the following diagrams of the skulls of a chimpanzee, an *Australopithecine* and a modern human.

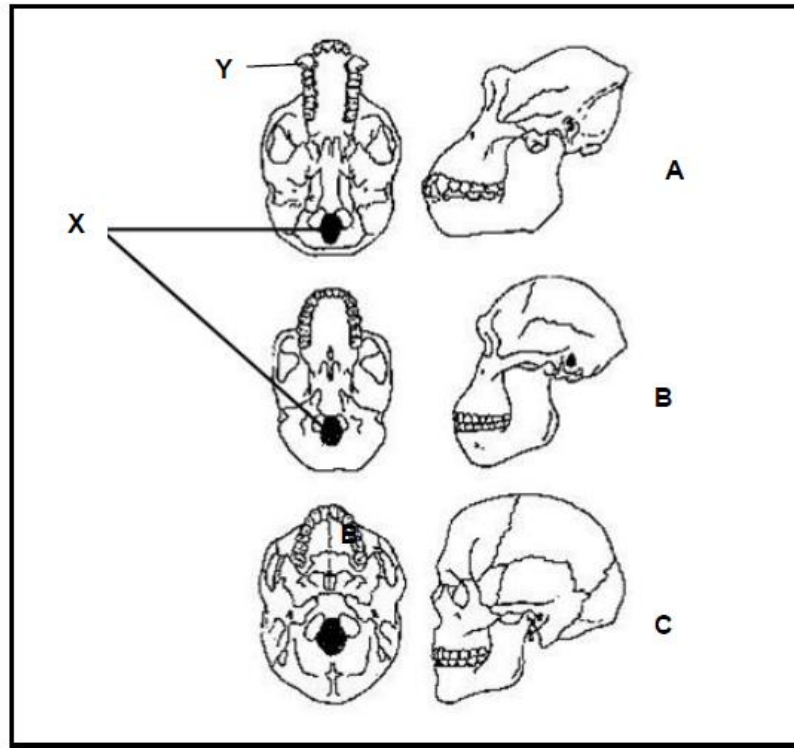


- 3.1.1 Compare the difference between the size of the teeth of the human and the chimpanzee AND explain the reason for this development. (4)
- 3.1.2 Apart from the difference in teeth size, tabulate THREE other differences between the skull of the chimpanzee and the skull of the human that are visible in the diagram. (7)
- 3.1.3 In all three skulls the eyes are facing forward. Explain the significance of this characteristic. (3)

(14)

ADAPTED BY MR S.J SILAULE

- 3.4 The diagram below represents the fossilised skulls of three different species of primates. They were either bipedal or quadrupedal (organisms that habitually walk on all four limbs).



- 3.4.1 Label part **X** and the type of teeth at **Y**. (2)
- 3.4.2 Explain the significance of the location of structure **X** in organism **C**. (3)
- 3.4.3 Which of the skulls (**A**, **B** or **C**) belongs to:
- (a) An *Australopithecine* (1)
 - (b) A quadrupedal primate (1)
- 3.4.4 Explain how the change in the skull from **B** to **C** could indicate a change in intelligence. (3)
- 3.4.5 Tabulate TWO observable differences, other than those mentioned in QUESTIONS 3.4.2 and 3.4.4, between skulls **B** and **C** that represent trends in human evolution. (5)
(15)

ADAPTED BY MR S.J SILAULE

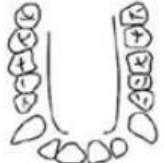
- 3.5 The table below shows the average brain volume for various hominids. Study the table and answer the questions that follow.

HOMINID	AVERAGE BRAIN VOLUME (CM ³)
<i>Australopithecus afarensis</i>	440
<i>Australopithecus africanus</i>	450
<i>Homo habilis</i>	575
<i>Homo erectus</i>	1 100
<i>Homo sapiens</i>	1 450

- 3.5.1 Draw a bar graph showing the average brain volume for various hominids. (6)
- 3.5.2 Which hominid has the largest brain volume? (1)
- 3.5.3 Describe the relationship between the hominid evolution and brain volume. (3)
- 3.5.4 State TWO advantages of a bigger brain volume. (2)

ADAPTED BY MR S.J SILAULE

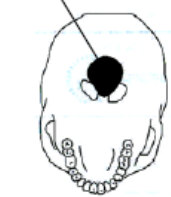
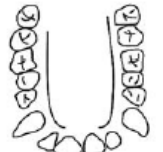
- 1.5 The diagrams below shows the upper jaw and skull of organisms A and B. Study the diagrams and answer the questions that follow.

Organism	Upper jaw	Skull (bottom view)
A		
B		

- 1.5.1 Mention ONE visible difference between the palate shape and teeth (dentition) of organisms A and B. (4)
- 1.5.2 Identify the organism (A or B) which is more likely to be bipedal. (1)
- 1.5.3 Explain the choice of your answer to QUESTION 1.5.2. (2)
- (7)

ADAPTED BY MR S.J SILAULE

- 3.3 Study the diagrams below of the upper jaw, skull and the foot of two organisms **A** and **B**. The diagrams are NOT drawn to scale.

Organism	Upper jaw	Skull (bottom view)	Foot
A			
B			

3.3.1 With regard to the drawings above:

- (a) Tabulate TWO visible differences between the upper jaws of organisms **A** and **B**. (5)
- (b) Name ONE visible difference between the feet of organisms **A** and **B**. (2)

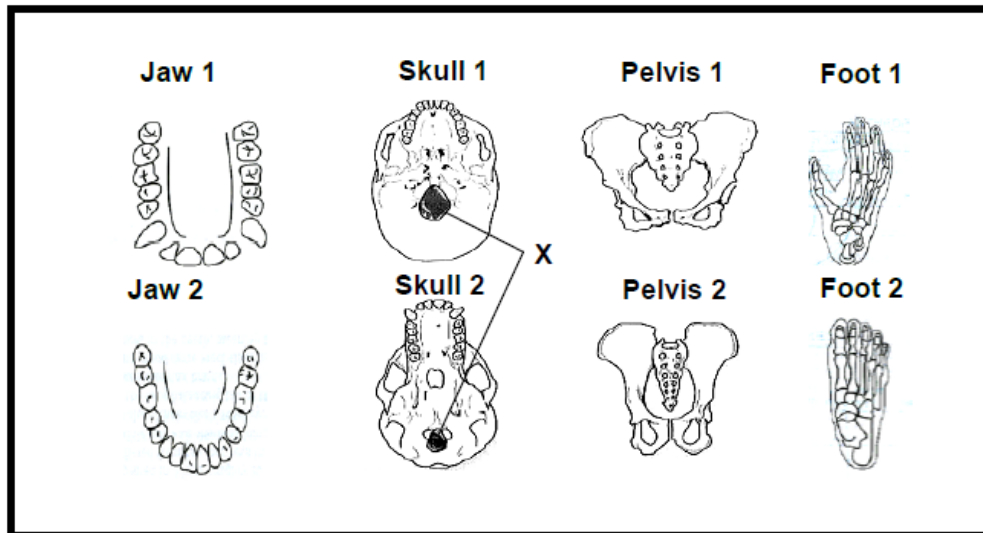
3.3.2 Which organism (**A** or **B**) is more likely to be bipedal? (1)

3.3.3 Give a reason for your answer to QUESTION 3.3.2. (2)

(10)

ADAPTED BY MR S.J SILAULE

- 3.2 The diagrams below represent some of the parts found in two different organisms (organism A and organism B). Study them and answer the questions that follow.



- 3.2.1 Redraw the table below and use the information in the diagrams above to match the characteristics of the different parts (1 and 2) from the diagram that belong to each organism.

Characteristic	Organism A	Organism B
Jaw		
Pelvis		
Foot		
Skull		

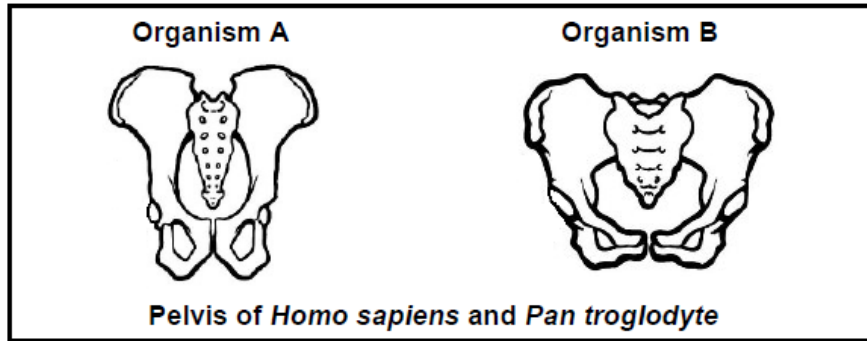
(8)

- 3.2.2 Which pelvis (1 or 2) represents that of a non-human primate? (1)
- 3.2.3 Identify the structure marked X. (1)
- 3.2.4 Explain how the structure mentioned in QUESTION 3.2.3 has changed to explain evolutionary trends in primates. (3)

(13)

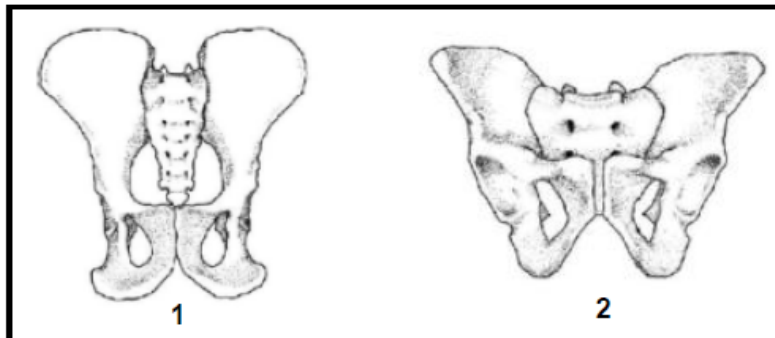
ADAPTED BY MR S.J SILAULE

- 3.3 Study the diagrams below showing the pelvis of *Homo sapiens* and *Pan troglodyte* (chimpanzee). The diagrams are not drawn to scale.



- 3.3.1 Which organism, **A** or **B**, is bipedal? (1)
- 3.3.2 Give **ONE** observable reason for your answer to QUESTION 3.3.1. (2)
- 3.3.3 Explain **TWO** advantages of bipedalism. (4)
(7)

- 3.3.4 The diagram below represents the pelvis associated with hominids I and II. (The diagrams are not drawn to scale)

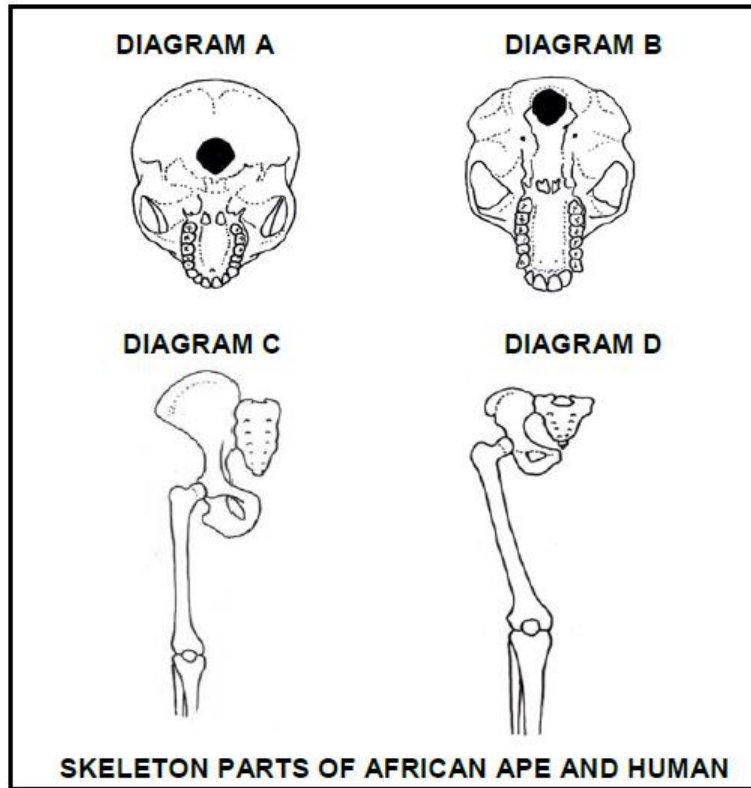


[<https://jkendrickensis.wordpress.com>]

- (a) Which pelvis, 1 or 2, belongs to hominid II? (1)
- (b) List **TWO** characteristics of the pelvis that supports your answer in QUESTION 3.3.5(a). (2)
- (c) Describe the shape of the spine that is associated with pelvis 1. (1)
(15)

ADAPTED BY MR S.J SILAULE

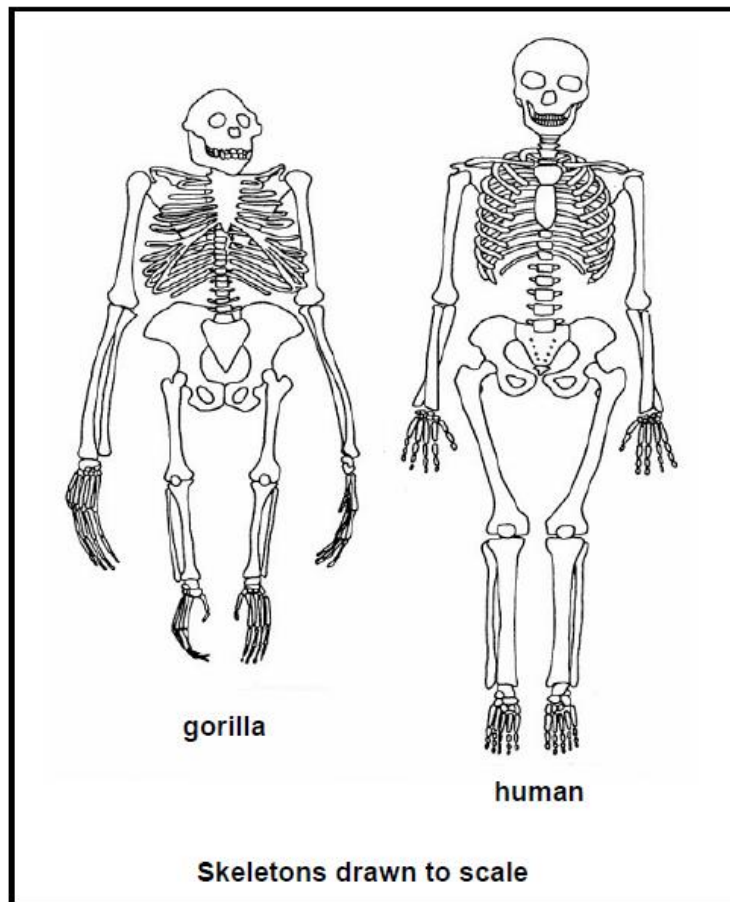
- 3.3 The diagrams below represent parts of the skeletons of an African ape and a human. Diagrams **A** and **B** are drawn to scale.



- 3.3.1 Write down the LETTERS only of the diagrams (A–D) that represent bipedal organisms. (2)
- 3.3.2 Explain how the shape of the pelvis contributes to bipedalism. (2)
- 3.3.3 Explain the significance of the position of the foramen magnum in the skulls in diagram A and in diagram B. (4)
- 3.3.4 Tabulate THREE visible differences between the jaws/teeth of the skulls labelled A and B that indicate trends in human evolution. (7)
- 3.3.5 State THREE physical characteristics of the forelimb/upper limb that humans share with African apes. (3)
- (18)**

ADAPTED BY MR S.J SILAULE

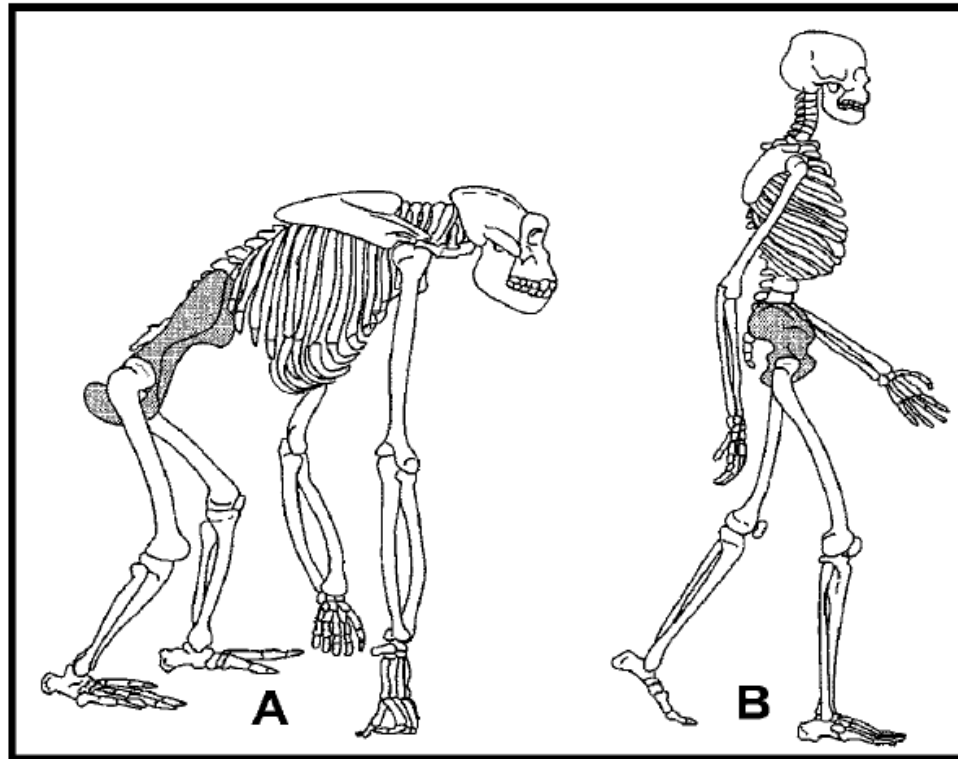
3.1 Study the two skeletons below and answer the questions that follow.



- 3.1.1 Tabulate THREE visible differences between the skeleton of a gorilla and that of a human. (7)
- 3.1.2 List THREE characteristics that we share with other primates. (3)
- (10)

ADAPTED BY MR S.J SILAULE

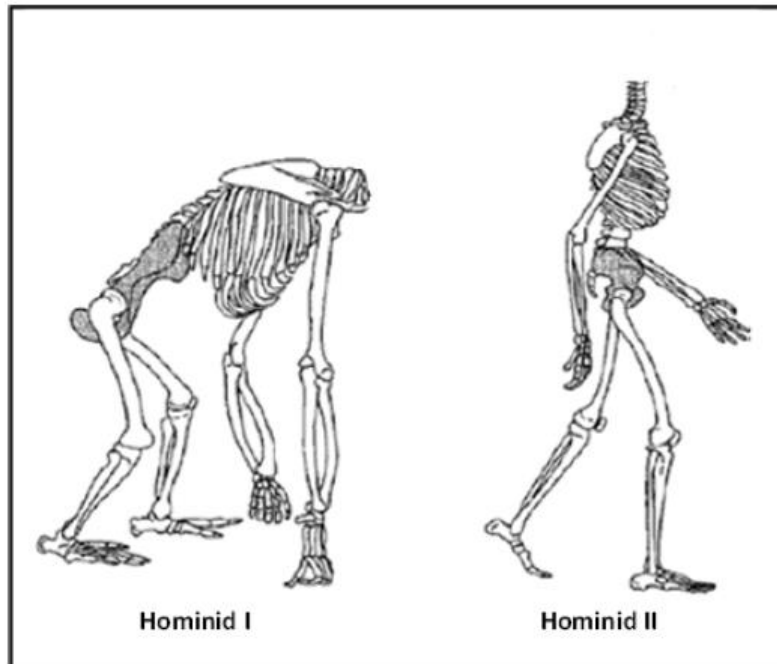
- 3.3 The diagram below shows the skeletons of two hominids. Study the diagram and answer the following questions.



- 3.3.1 Which one of the above organisms (**A** or **B**) is a bipedal organism? (1)
- 3.3.2 Give an observable reason to support your answer in QUESTION 3.3.1. (1)
- 3.3.3 Mention any TWO advantages of bipedalism. (2)
- 3.3.4 Describe TWO ways in which the toes of organism **A** are adapted for arboreal life. (2)
- 3.3.5 Mention any TWO characteristics that organism **A** and **B** share with each other. (2)

ADAPTED BY MR S.J SILAULE

3.3 The diagrams below show the skeletons of **TWO** hominids without their skulls.



3.3.1 Which hominid, I or II ...

- (a) belongs to the genus Homo? (1)
- (b) has more characteristics in common with an African ape? (1)

3.3.2 List **TWO** characteristics, of the upper limbs, shared by the two hominids. (2)

- 3.3.3 (a) Which hominid, I or II, is bipedal? (1)
- (b) Explain **THREE** advantages of bipedalism to the hominid in QUESTION 3.3.3(a). (6)

ADAPTED BY MR S.J SILAULE

3.4 The table below shows the cranial capacities of different species of primates.

Species	Cranial capacity (cm ³)
Chimpanzee	400
Gorilla	550
<i>Australopithecus</i> sp.	500
<i>Homo habilis</i>	650
<i>Homo erectus</i>	1 000
<i>Homo sapiens</i>	1 500

[Adapted from *Advanced Biology*, M Kent, 2000]

- 3.4.1 State TWO advantages of the large cranial capacity of *Homo sapiens*. (2)
- 3.4.2 Draw a bar graph to represent the data in the table. (6)
(8)

3.3 Humans and African apes share many characteristics, yet each is a distinct species.

- 3.3.1 Name FIVE characteristics that humans share with African apes. (5)
- 3.3.2 Describe how each of the following structures is different between humans and apes:
- (a) Spine (2)
- (b) Pelvic girdle (2)
- 3.3.3 Explain the significance of the changes to the teeth of humans that show progression in evolution. (4)
(13)

ADAPTED BY MR S.J SILAULE

8. Out of Africa hypothesis

- 3.2 Describe TWO lines of evidence which support the idea that the human population had its origins on the African continent. (4)

- 3.2 Study the table below, which indicates some of the hominid fossils found in different parts of the world.

SPECIES	AREA WHERE IT WAS FOUND	PERIOD OF EXISTENCE
<i>Australopithecus afarensis</i>	Eastern Africa	3,4–2,8 mya
<i>Australopithecus africanus</i>	Southern Africa	2,1–2,8 mya
<i>Australopithecus sediba</i>	Southern Africa	2,0–1,9 mya
<i>Homo habilis</i>	Sub-Saharan (Africa)	2,3–1,4 mya
<i>Homo erectus</i>	Africa, Europe, Asia	1,5–0,2 mya
<i>Homo heidelbergensis</i>	Europe, China	0,6–0,35 mya
<i>Homo neanderthalensis</i>	Europe, Western Asia	0,35–0,03 mya
<i>Homo sapiens</i>	Worldwide	0,2 mya–present

[Adapted from *The Evolutionary Road*, Jamie Shreeve, *National Geographic*, July 2010]

- 3.2.1 Explain why the information in the table supports the 'Out of Africa' hypothesis. (2)
- 3.2.2 Describe how the analysis of mitochondrial DNA is used to support the 'Out of Africa' hypothesis. (3)
- (5)

- 3.2 Study the passage on evolution below and answer the questions that follow.

The 'Out of Africa' hypothesis suggests that primitive humans migrated from Africa to all other continents of the world about 1,8 million years ago. Scientists that studied some fossilised bones of early humans that lived in Europe concluded that humans were unable to digest cow's milk before 7 000 years ago.

A mutation occurred that resulted in some individuals of the human population living in Europe being able to digest cow's milk. This ability was beneficial as it provided additional nutrients all year round. Milk is a source of vitamin D and calcium.

[Adapted from *Impact of Selection and Demography on the Diffusion of Lactose Persistence*. PLoS ONE 4(7) D O'Rourke, 2009]

- 3.2.1 State ONE advantage of being able to digest cows' milk to early humans that lived in Europe. (1)

ADAPTED BY MR S.J SILAULE

3.2.2 Explain why the primitive humans that migrated out of Africa were unable to digest cows' milk. (2)

3.2.3 Apart from fossils, name ONE other type of evidence that can be used to support the 'Out of Africa' hypothesis. (1)
(4)

3.3 According to the "Out of Africa" hypothesis, humans originated in Africa and migrated to other parts of the world.

Describe mitochondrial DNA (mtDNA) as one line of evidence to support the above statement. (3)

3.2 The passage below refers to human evolution.

Research, using DNA evidence, suggests that all modern humans arose from a single group of *Homo sapiens* that migrated from Africa 2 000 generations ago and spread throughout Europe and Asia over thousands of years.

[Source: <http://images.sciencedaily.com>]

3.2.1 Name the hypothesis on human evolution that is described in the passage. (1)

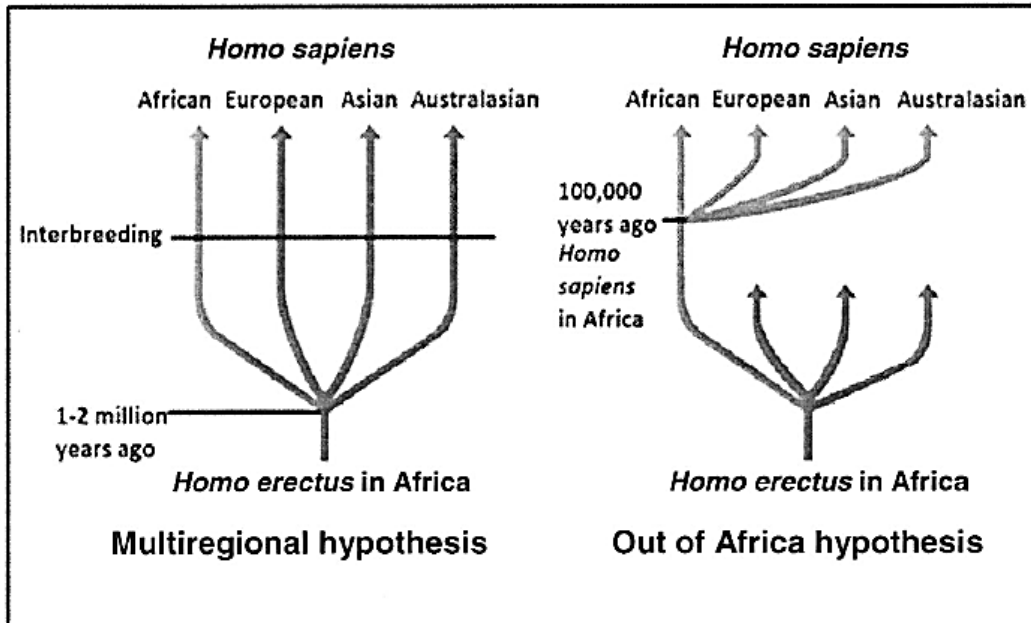
3.2.2 Name the type of DNA outside the nucleus that is analysed in support of the hypothesis named in QUESTION 3.2.1. (1)

3.2.3 Explain how the type of DNA named in QUESTION 3.2.2 is used to provide evidence for the hypothesis named in QUESTION 3.2.1. (3)

3.2.4 Apart from DNA evidence, state ONE other line of evidence that may be used to support the hypothesis mentioned in QUESTION 3.2.1. (1)
(6)

ADAPTED BY MR S.J SILAULE

- 2.3 The following diagram illustrates two different hypotheses about the origins of *Homo sapiens*.



- 2.3.1 Use the information in the diagram to describe the difference between the *Multiregional Hypothesis* and the *Out of Africa Hypothesis*. (4)
- 2.3.2 Describe how the genetic evidence that is available supports the *Out of Africa Hypothesis*. (4)
- (8)

ADAPTED BY MR S.J SILAULE

9. INVESTIGATIONS

- 3.1 The shell of the banded snail, *Cepaea nemoralis*, displays a wide variety of both colour and banding (rings). Birds, such as thrushes, eat these snails. The birds break open the shells by striking the snails against a stone.

It was found that there were equal numbers of light- and dark-banded snails in a specific grassland habitat where no thrushes were found. A population of thrushes was then introduced to this grassland habitat.

An investigation was done to determine which colour snails (dark-banded or light-banded) were eaten most by the thrushes.

The results are shown below:

Time (days)	Number of dark-banded shells found around stone	Number of light-banded shells found around stone
Day 1	2	1
Day 2	3	0
Day 3	5	1
Day 4	7	0
Day 5	8	1

- 3.1.1 Write a possible hypothesis for this investigation. (3)
- 3.1.2 What phenomenon does this investigation illustrate? (1)
- 3.1.3 Which snails were better adapted to prevent them from being eaten by the thrushes? (1)
- 3.1.4 Explain your answer to QUESTION 3.1.3. (2)
- 3.1.5 Why can the number of snails at the start of the investigation be considered a controlled variable? (1)
- (8)**

ADAPTED BY MR S.J SILAULE

- 3.3 The peppered-moth, *Biston betularia*, has two phenotypes for body colour, dark (blackish) and pale (whitish). The trunks of the trees on which the moths rest are black in polluted environments compared to the white trunks of trees in unpolluted environments. In both unpolluted and polluted environments, birds are the predators of the moths.

An investigation was carried out to determine the number of dark and pale peppered-moths present in polluted and unpolluted environments using a sampling technique.

The results of the investigation are shown in the table below.

TYPE OF ENVIRONMENT	DARK MOTHS	PALE MOTHS
Polluted	150	40
Unpolluted	30	170

- 3.3.1 Formulate a hypothesis for the above investigation. (3)
- 3.3.2 Suggest THREE factors that might have decreased the validity of this investigation. (3)
- 3.3.3 Using the table and your understanding of natural selection, explain the results for the polluted environment. (4)
(10)

ADAPTED BY MR S.J SILAULE

3.1 Study the table below which represents the following two sets of data and answer the questions that follow:

- (1) The percentage appearance of dark coloured peppered moths in a specific year
- (2) Amount of pollution

Year	Appearance of dark coloured peppered moth (%)	Year	Pollution (in $\mu\text{g}/\text{m}^3$)
1960	95	1963	150
1965	91	1964	105
1967	94	1967	60
1968	91	1968	70
1969	94	1970	40
1970	92	1971	50
1976	84	1972	35
1977	88	1973	37
1980	77	1976	20
1982	73	1981	15
1985	55	1985	20

- 3.1.1 Use the data in the table to draw TWO line graphs on the same set of axes. (13)
- 3.1.2 Briefly describe the changes in the levels of pollution and the quality of the air from 1960 – 1985. (2)
- 3.1.3 Suggest a possible reason for the changes mentioned in QUESTION 3.1.2. (2)
- 3.1.4 The number of dark coloured peppered moths decreased at a slower rate than the levels of pollution. Explain this phenomenon. (4)

ADAPTED BY MR S.J SILAULE

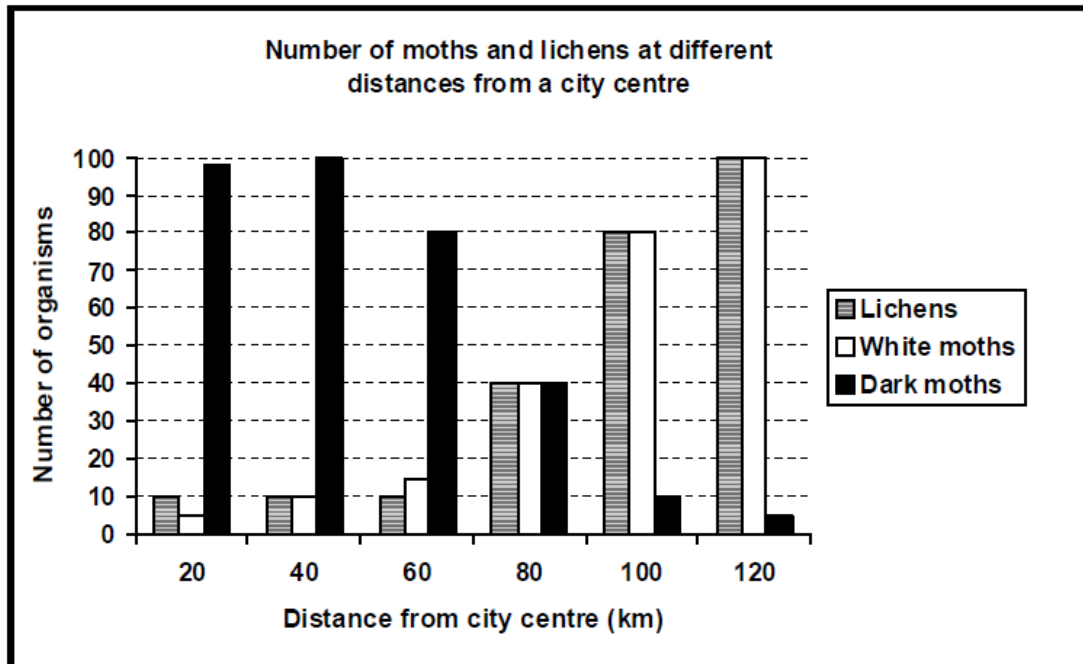
- 4.1 The table below shows the population size of the dark-coloured peppered moth as a percentage of the total peppered-moth population and the amount of pollution in an industrial area over time.

YEAR	POPULATION SIZE (%)	AMOUNT OF POLLUTION (g/m ³)
1750	35	15
1760	37	20
1770	40	30
1780	55	65
1790	60	85
1800	80	100
1810	95	135
1820	100	145

- 4.1.1 Give the table above a heading. (2)
- 4.1.2 Name the dependent variable in this investigation. (1)
- 4.1.3 Make a general conclusion about the relationship between the population size and the amount of pollution. (2)
- 4.1.4 Plot TWO line graphs on the same set of axes to represent the data above. (12)
(17)

ADAPTED BY MR S.J SILAULE

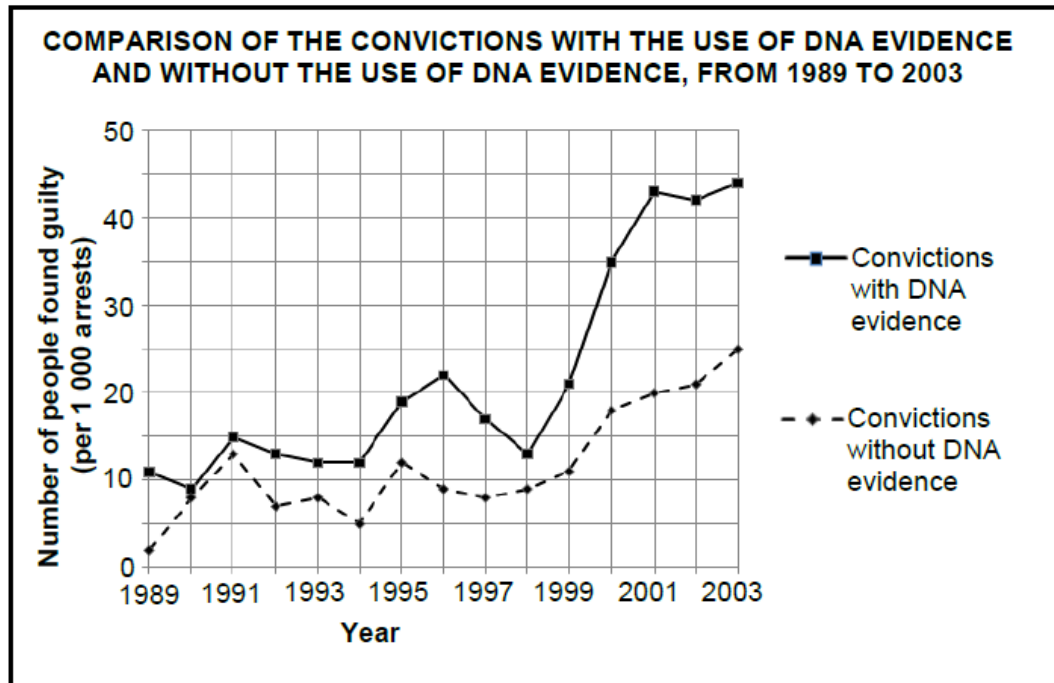
- 2.1 Lichens are small, light-coloured organisms that can be used as pollution indicators. They generally flourish in rural areas but do not appear in industrial areas which are normally near the city centre. The graph below shows the number of white moths and dark moths as well as the number of lichens at various distances from a city centre.



- 2.1.1 At what distance from the city centre is the number of white moths and dark moths and lichens the same? (1)
- 2.1.2 Describe the relationship between the distribution of lichens, dark moths and white moths as the distance from the city centre increases. (4)
- 2.1.3 Explain why lichens do not grow in industrial areas. (2)
- 2.1.4 Predict how the population of white moths and black moths will change if pollution is reduced in the industrial area. (2)
- 2.1.5 Explain your answer to QUESTION 2.1.4. (4)
- (13)**

ADAPTED BY MR S.J SILAULE

- 2.4 The graph below represents the results of an investigation which compares the conviction (number of people found guilty) of criminals with the use of DNA evidence and without the use of DNA evidence from 1989 to 2003.



[Adapted from <http://www.mindfully.org>]

- 2.4.1 Formulate a hypothesis for this investigation. (2)
- 2.4.2 State the dependent variable in this investigation. (1)
- 2.4.3 How many more successful convictions per 1 000 arrests were made in 2003 with the use of DNA evidence? Show ALL calculations. (2)
- 2.4.4 A DNA database is a collection of the DNA profiles of all the citizens of a country.

Explain how you would use the information in the graph to convince the government to create a DNA database.

(4)
(9)

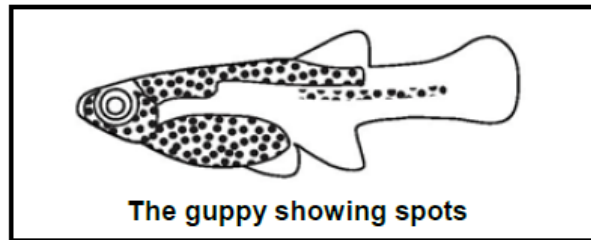
ADAPTED BY MR S.J SILAULE

- 2.4 A scientist used guppies (*Poecilia reticulata*) in an investigation to test Darwin's theory of natural selection.

Male guppies have brightly coloured spots to attract females, but these spots also attract predators.

It was previously observed that males living in streams where there were many predatory fish tended to have fewer spots. This reduced their risk of being eaten.

Those males living in streams with fewer predators had more spots.



[Adapted from <http://www.decodedscience.org>]

The procedure of the investigation was as follows:

- Equal numbers of male and female guppies were put in two ponds (pond 1 and pond 2).
- In pond 1, predatory fish that prey on guppies were introduced.
- In pond 2, predatory fish that do not feed on guppies were introduced.
- The guppies were allowed to breed for 20 months, representing several generations of guppies. (Guppies reproduce when they are about three months old.)

The result of the investigation was:

The male guppies in pond 2 had significantly more spots than the male guppies in pond 1.

- 2.4.1 How could the validity of this investigation be increased? (2)
- 2.4.2 Identify the:
- (a) Independent variable (1)
- (b) Dependent variable (1)
- 2.4.3 Explain why the scientist included pond 2 in this investigation. (3)
- 2.4.4 Describe how Darwin's theory of natural selection can be used to explain why the guppies in pond 1 had fewer spots. (5)
- (12)

ADAPTED BY MR S.J SILAULE

- 3.4 Finches of the species *Geospiza fortis* are found on one of the Galápagos Islands. There was variation in the size of their beaks.

All the finches used to feed on small, soft seeds which were plentiful on the island. Then the island was affected by a severe drought which made food scarce.

Many of the plants on the island died. The small, soft seeds were all gone. Only hard, woody seeds remained.

Scientists conducted an investigation to determine the relationship between beak size and survival of the finches before and during the drought.

The table below shows the results of part of the investigation.

BEAK SIZE (mm)	TOTAL NUMBER OF FINCHES BEFORE THE DROUGHT	TOTAL NUMBER OF FINCHES DURING THE DROUGHT
7,3	2	0
7,8	12	2
8,3	30	4
8,8	48	4
9,3	45	6
9,8	40	8
10,3	25	10

[Adapted from *Excerpt Evolution*, Roberts et al.]

- 3.4.1 List FOUR steps that the scientists followed to obtain their results. (4)
- 3.4.2 Name the independent variable of this investigation. (1)
- 3.4.3 Describe the relationship between the number of finches during the drought and beak size. (2)
- 3.4.4 Give a possible reason for the relationship in your answer to QUESTION 3.4.3. (3)
- 3.4.5 Predict which beak size(s) would be present in the population if the drought continued. (1)
- (11)

ADAPTED BY MR S.J SILAULE

2.4 Study the extract and the information below.

A species of the clover plant (*Trifolium repens*) developed a mutation that caused the poison, cyanide, to form in the plant's cells. This gives the clover a bitter taste to herbivores that feed on them. However, in a colder climate, some cells burst, releasing the cyanide into the plants' tissues, thereby killing the plants.

Scientists observed that there were more clover plants of this species in warmer areas than in colder areas. They formulated a hypothesis that more clover plants survive at higher temperatures.

They conducted the investigation on the survival of clover plants at different temperatures as follows:

- They placed 200 clover plants in a greenhouse with the temperature controlled at 5 °C and 200 clover plants in a greenhouse with the temperature controlled at 25 °C.
- They controlled all other variables.
- They allowed a period of time for the plants to grow and counted the number of clover plants that survived in each greenhouse.
- Then they calculated the percentage survival of clover plants.

The results of the investigation are shown in the table below.

TEMPERATURE	PERCENTAGE SURVIVAL OF CLOVER PLANTS
5 °C	13
25 °C	72

2.4.1 State the:

- (a) Independent variable (1)
- (b) Dependent variable (1)

2.4.2 State TWO ways in which the scientists could have improved the reliability of the investigation. (2)

2.4.3 Describe how the scientists calculated the percentage survival of clover. (2)

2.4.4 Explain if the hypothesis will be accepted or rejected. (3)

2.4.5 Based on information in the passage, apart from temperature, explain ONE other way in which the survival rate of clover plants is increased. (2)

2.4.6 Refer to Darwin's theory of natural selection and explain how the mutation affected the survival of the clover plants at lower temperatures. (6)
(17)

ADAPTED BY MR S.J SILAULE

- 3.3 A species of mice have different fur colours in different habitats. Scientists observed that there were more mice with a lighter fur colour in a beach habitat where the sand was lighter in colour. Also, there were more mice with a darker fur colour in the mainland habitat where the sand was darker in colour. Owls attack and prey on the mice.

Scientists wanted to investigate how the colour of the fur affects the chances of the mice being attacked. They conducted a simulation where they used models to represent the mice.

While conducting the investigation they:

- Made clay models of the mice
- Painted 200 clay models to resemble the lighter fur colour and 200 models to resemble the darker fur colour
- Placed an equal number of mice of each colour randomly in the beach habitat and in the mainland habitat
- Allowed enough time for predators to attack the mice models
- Collected all the models and recorded the number that were damaged after being attacked

The results of the investigation are shown in the diagram below.

HABITAT	FUR COLOUR	NUMBER OF MODELS ATTACKED
Mainland	Lighter	80
	Darker	20
Beach	Lighter	26
	Darker	78

- 3.3.1 State TWO independent variables. (2)
- 3.3.2 How many mice with a lighter fur colour were placed in the beach habitat? (1)
- 3.3.3 State TWO ways in which the scientists ensured the reliability of the results. (2)
- 3.3.4 Give a conclusion for the investigation conducted in the mainland habitat. (2)
- 3.3.5 Explain the results obtained for the beach habitat. (4)
- 3.3.6 Explain why the simulation may not be an accurate representation of the survival of the mice. (2)
- (13)

ADAPTED BY MR S.J SILAULE

- 3.3 The shell of the banded snail, *Cepaea nemoralis*, displays a wide variety of both colour and banding (rings). Birds, such as thrushes, eat these snails. The birds break open the shells by striking the snails against a rock.

It was found that there were equal numbers of light- and dark-banded snails in a specific habitat where no thrushes were found. A population of thrushes was then introduced to this habitat.

An investigation was done to determine which colour snails (dark-banded or light-banded) were eaten most by the thrushes.

The results are shown below:

TIME (DAYS)	NUMBER OF BROKEN DARK-BANDED SHELLS FOUND AROUND ROCKS	NUMBER OF BROKEN LIGHT-BANDED SHELLS FOUND AROUND ROCKS
Day 1	4	2
Day 2	6	0
Day 3	6	1
Day 4	8	0
Day 5	12	3

- 3.3.1 Use the information in the table and draw two line graphs on the same set of axis to show the results from the investigation. (7)
- 3.3.2 Which snails were better adapted to prevent them from being eaten by the thrushes? (1)
- 3.3.3 Use the theory of natural selection to explain the results in the table. (6)
- 3.3.4 How would Lamarck explain the results in the table? (4)
- 3.3.5 Explain why Lamarck's theory is NOT accepted. (2)

1401

ADAPTED BY MR S.J SILAULE

10. ESSAYS

QUESTION 4

Describe how meiosis and different types of mutations contribute to genetic variation and the role of this variation in natural selection.

Content: (17)

Synthesis: (3)

QUESTION 4

4.1 Describe how mutation and its effects increase variation and the impact of it on natural selection.

(17)

Synthesis (3)

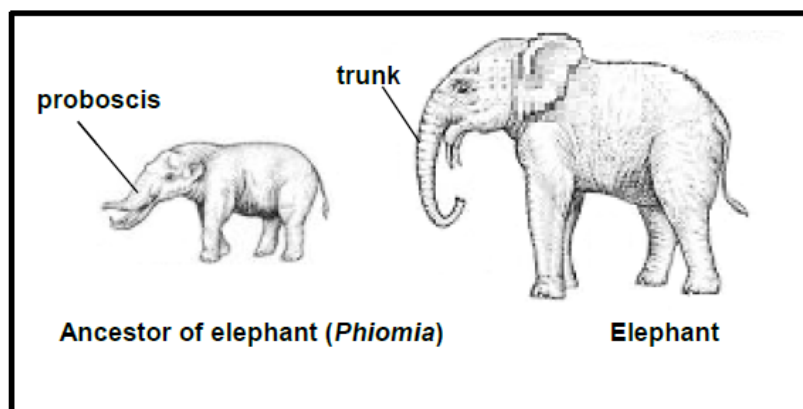
QUESTION 4

Describe the mechanisms that cause variation within a species.

(17)

Synthesis (3)

An ancestor of the elephant, *Phiomia*, had a long nose-like structure called a proboscis which evolved into the trunk of the elephant. The proboscis was used to gather leaves as food. The proboscis of *Phiomia* and the trunk of the elephant are shown below. The diagrams have been drawn to scale.



Explain the evolution of the elephant's trunk in terms of Lamarckism and Darwinism as well as the way in which an increase in the length of the trunk of the elephant could be achieved through artificial selection.

Content: (17)

ADAPTED BY MR S.J SILAULE

QUESTION 4

The theory of evolution states that:

"Everything we see today arose from that which existed in the past; however it may look different because things change with time."

Name and describe the principle(s) that Lamarck and Darwin used to explain how evolution took place. In your explanation, give reasons why Lamarck's theory was not accepted.

QUESTION 4

Describe how Lamarck and Darwin explained evolution, and compare Darwin's ideas to the ideas of Punctuated Equilibrium.

Content: (17)
Synthesis: (3)

- 4.3 One of the observations Darwin made during his study of pigeons was about artificial selection. In 1859 Darwin and Wallace jointly proposed that new species could develop by a process of natural selection.

Using examples, describe natural and artificial selection and also highlight the differences between these two processes.

Content: (17)
Synthesis: (3)

QUESTION 4

Describe Darwin's theory of Natural Selection and explain how it could lead to speciation by geographical isolation.

Content: (17)
Synthesis: (3)

QUESTION 4

Differentiate between a *population* and a *species*, describe speciation by geographic isolation and explain how speciation and extinction affect biodiversity.

Content: (17)
Synthesis: (3)
(20)

ADAPTED BY MR S.J SILAULE

QUESTION 4

The anole lizard of the Caribbean Islands represents a group of about 150 closely related species, which evolved within the past 50 million years from a single species.

Use this example to describe how natural selection led to the process of speciation that gave rise to the 150 different species of lizards.

Content: (17)
 Synthesis: (3)
 (20)

It is thought that modern humans evolved gradually from ape-like beings over millions of years through speciation.

Describe how a single species can form new species, and explain how the differences in the skulls and other parts of the skeleton of primitive ape-like beings and modern humans support the idea that the general trend in human evolution has been towards bipedalism and a change in diet from raw food to cooked food.

Content: (17)
 Synthesis: (3)
 (20)

4.1

It is thought that modern humans evolved gradually from ape-like beings over millions of years through speciation.

Explain how the differences in the skulls and other parts of the skeleton of primitive ape-like beings and modern humans support the idea that the general trend in human evolution has been towards bipedalism and a change in diet from raw food to cooked food.

(17)
 Synthesis (3)

QUESTION 4

Describe the structural changes to the body that correspond with changes in the diet and the change to bipedalism in the evolution of modern humans and explain the significance of these changes.

Content: (17)
 Synthesis: (3)
 (20)

QUESTION 4

Describe the evolutionary changes in the skull fossils of *Homo species* and the significance of each change as they evolved from the African apes.

(17)
 Synthesis (3)

ADAPTED BY MR S.J SILAULE

QUESTION 4

Fossils of the bipedal primates *Ardipithecus*, *Australopithecus* and early *Homo* species are used to support the 'Out of Africa' hypothesis.

State the 'Out of Africa' hypothesis. Describe the evidence that supports the 'Out of Africa' hypothesis and the evidence that shows that the three primate genera mentioned above, were all bipedal.

Content: (17)
 Synthesis: (3)
(20)

QUESTION 4

4. Describe the 'Out of Africa' hypothesis and how it is supported by comparing evolutionary trends visible in the fossil skulls of, *Ardipithecus*, *Australopithecus* and *Homo* species as well as how studies of mitochondrial DNA supports this hypothesis.

Content: (17)
 Synthesis: (3)

- 4.3 Write a short essay explaining what the "out of Africa" hypothesis is and supply genetic evidence and fossil evidence to support the hypothesis.

Content: (17)
 Synthesis: (3)

ADAPTED BY MR S.J SILAULE