

## HUMAN EVOLUTION

17 APRIL 2013

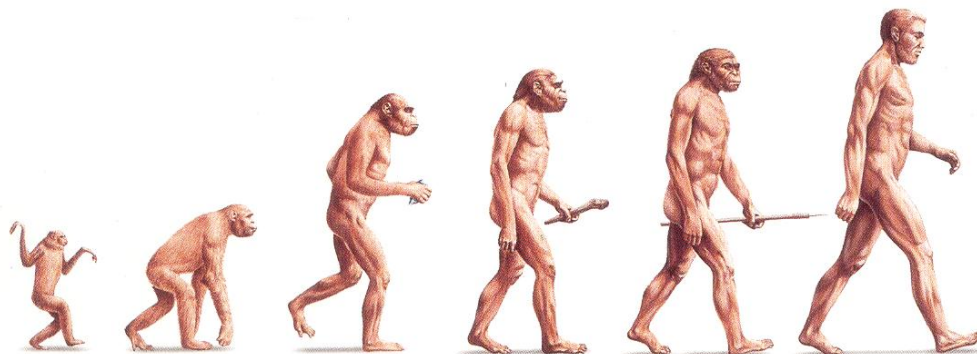
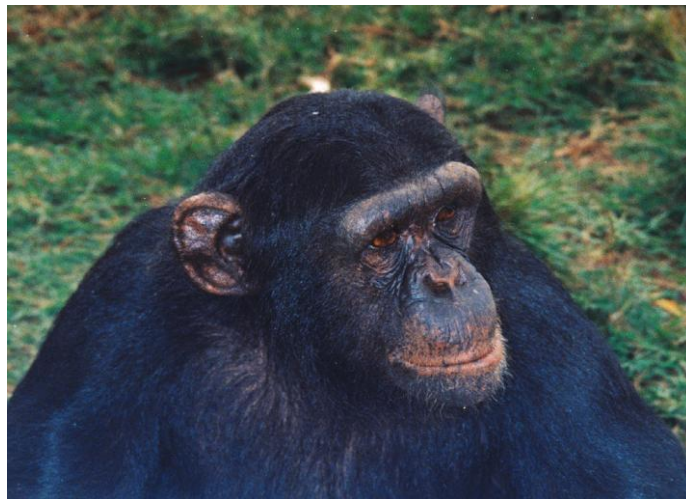
### Lesson Description

In this lesson, we:

- Consider the following aspects of Human Evolution:
  - Interpretation of a phylogenetic tree to show the place of the family Hominidae in the animal kingdom
  - Characteristics that we share with other primates
  - Characteristics that make us different from other primates
  - Progressive evolution of the above listed features from the ape-like beings to the humans: (using fossil evidence where indicated)
  - The contribution of African fossils to the understanding of human evolution
  - The 'Out of Africa' hypothesis
- Discuss evolution in present times
- Consider alternative explanations

### Key Concepts

Is this your ancestor?

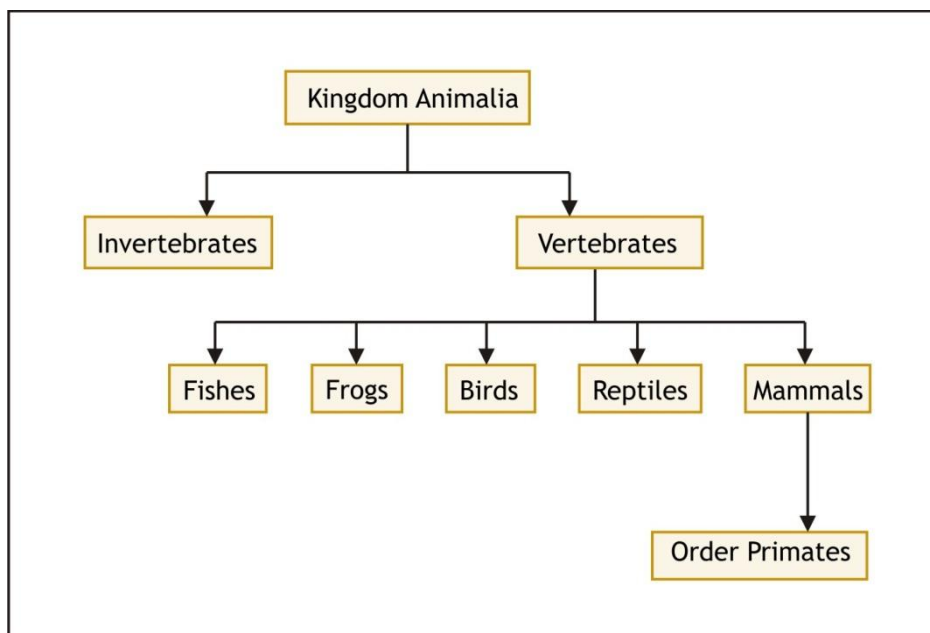


**Differences & Similarities from other primates**

DNA difference between humans and chimpanzees is 1%!



So where exactly do scientists place us?



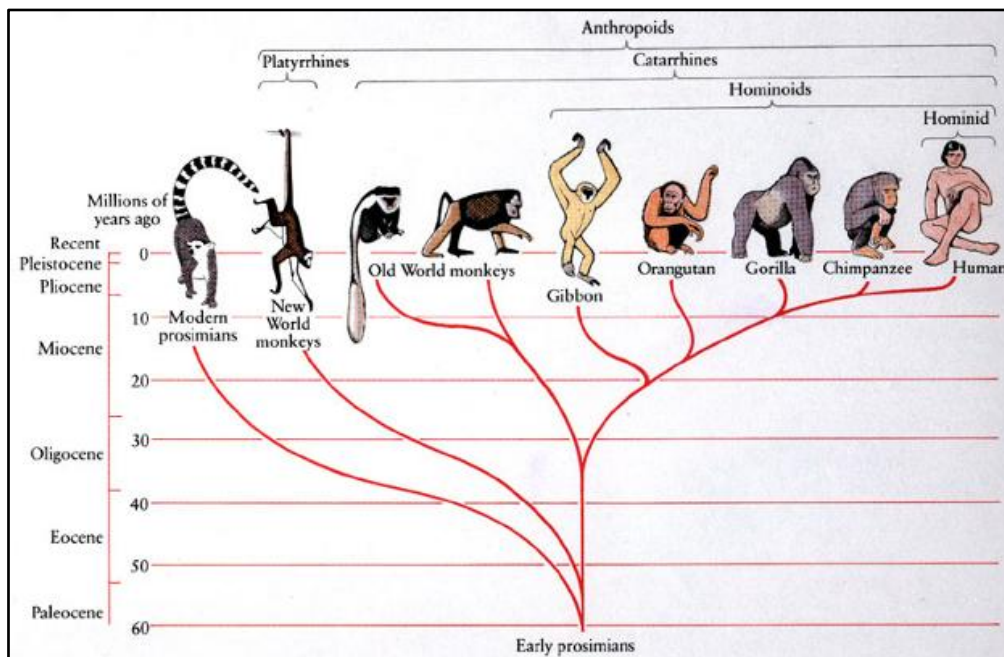
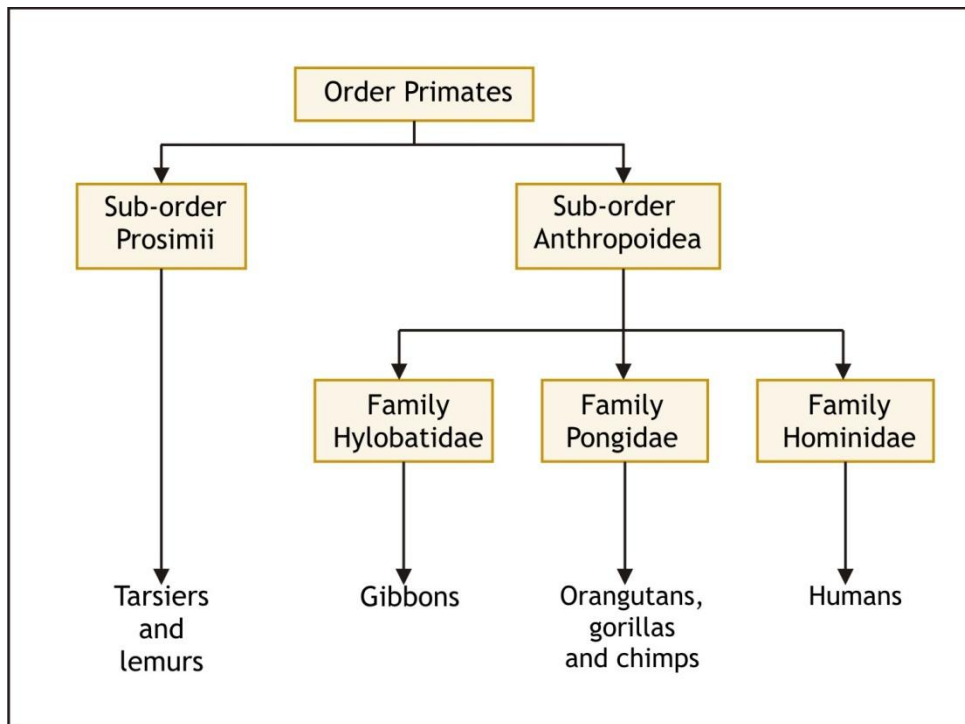


Fig. 1 Evolutionary path of humans and other primates



### Characteristics of primates other than humans



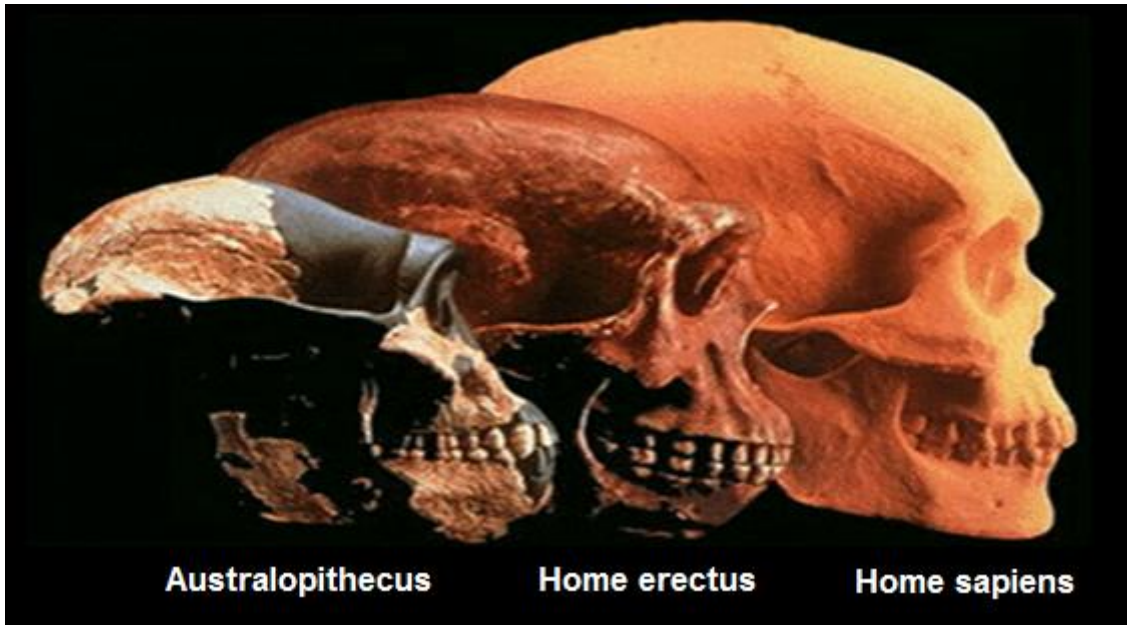
*Figure 6.30: Apes move through the trees hanging from branches and swinging along. This way of moving through trees is called 'brachiation'. (Life Sciences for All, Macmillan, Grade 12, Page 309).*



*Figure 6.31: Living primates other than humans have long canine teeth. (Life Sciences for All, Macmillan, Grade 12, Page 309)*

### Humans are unique among living primates

- Bipedalism (Always)
- Flat face (no prognathous)
- Dentition
- Smaller canines
- Jaws (with all teeth) are on a gentle curve
- Large brain
- Artificial language



### The Evolution of the Human Skull



**Australopithecines**  
Brain Capacity of  
400-530c.c.



**Homo Erectus**  
Brain Capacity of  
775-975c.c.



**Homo Sapiens**  
(Brain Capacity of  
1200-1600c.c.)

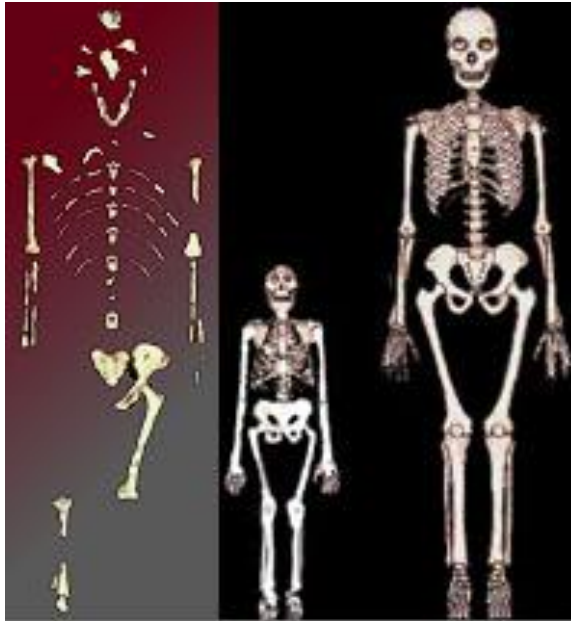


**Skull Size  
Comparison**

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### The contribution of African fossils to the understanding of human evolution

- First species - **Australopithecus afarensis** - 4.2 to 2.5 million years ago.  
 “Lucy” - Ethiopia.



- Next - **Australopithecus africanus** - 3.5 to 2.5 million years ago.  
 Famous fossils discovered in South Africa:

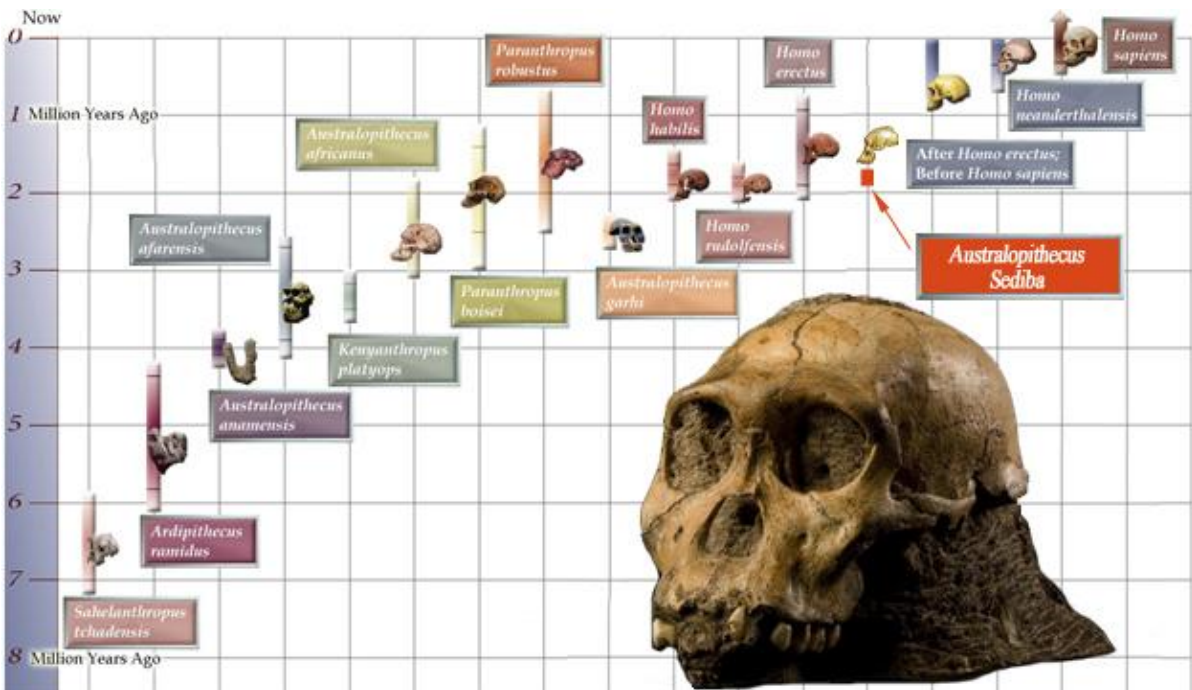
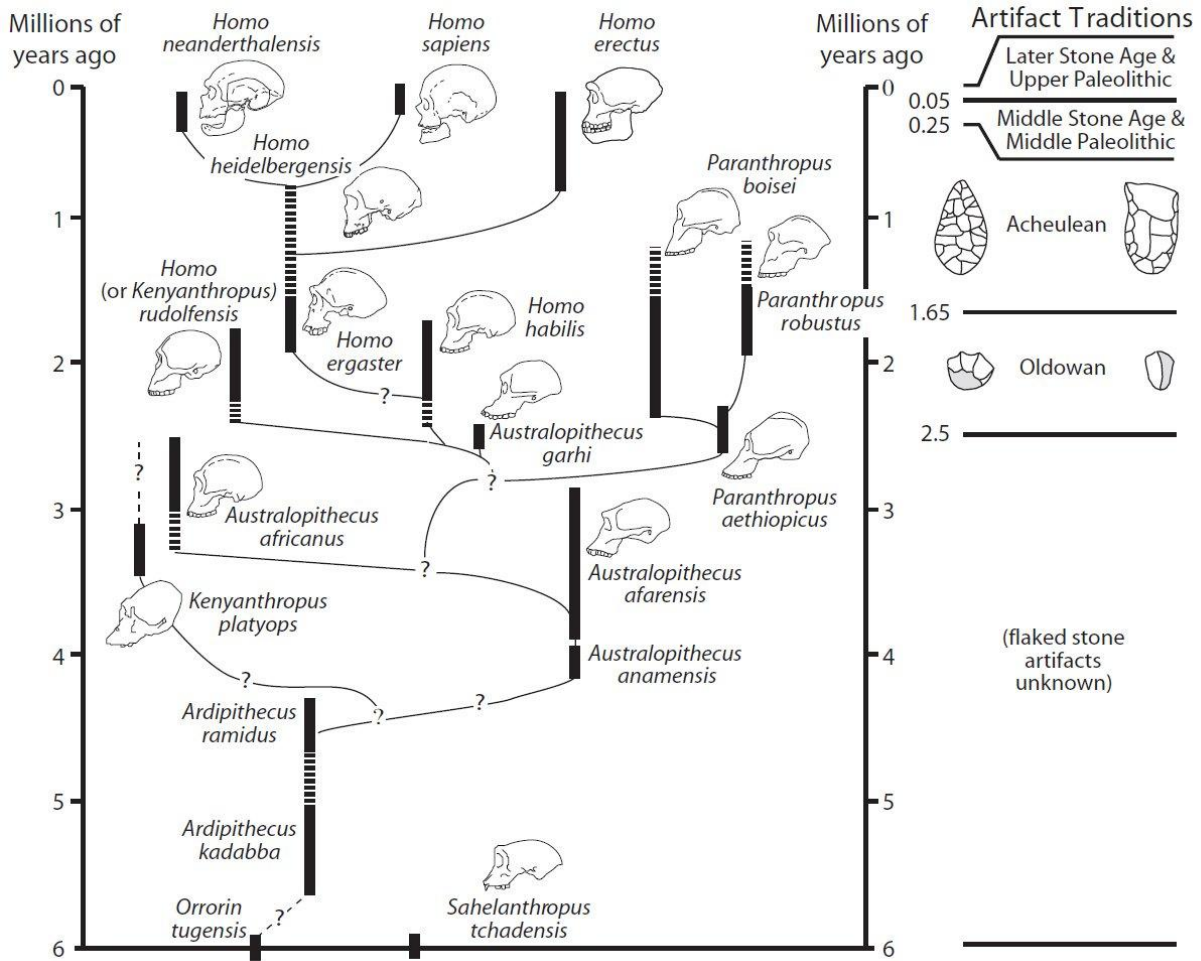
“**Taung child**” - Taung near Kimberley.

“**Mrs Ples**” - Sterkfontein caves.

“**Little Foot**” - Sterkfontein caves.

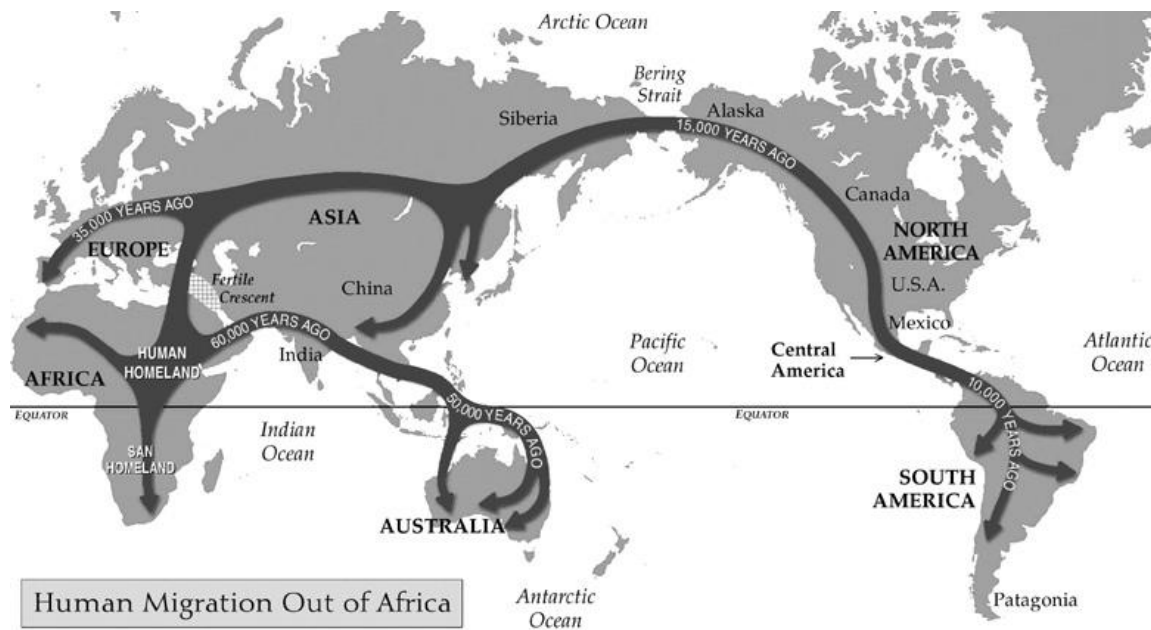
“**Karabo**” – Sterkfontein caves

- Next - **Homo habilis**, - 2 to 1.6 million years ago.
- Next - **Homo erectus** - 1.9 to 0.3 million years ago.
- Next - **Homo neanderthalensis**
- Last - **Homo sapiens** species which are considered to be our direct ancestors.





### Out of Africa Hypothesis



## Questions

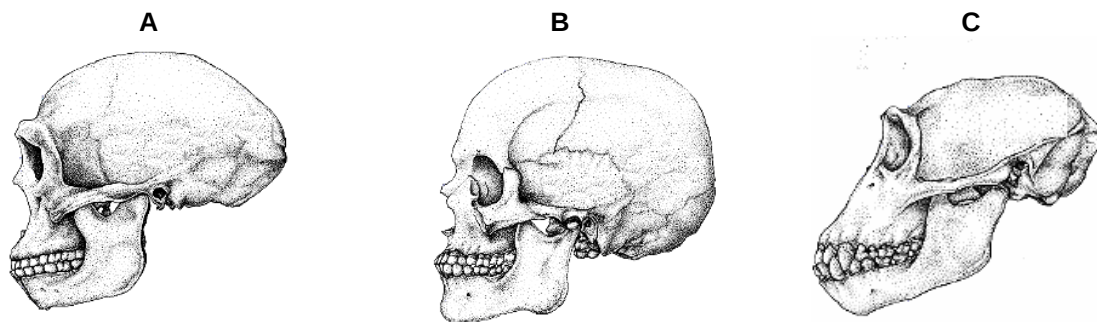
### Question 1

- a.) List features that humans share with primates. (5)
- b.) Tabulate five differences between humans and other primates. (11)

### Question 2

(Adapted from Nov 2011, NSC, Question 3.1 & 3.2, Paper 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.



- a.) Which diagram A,B or C appeared last on earth according to scientists. (1)
- b.) Tabulate THREE visible structural differences between DIAGRAM A and DIAGRAM B that illustrate evolutionary trends in human development. (7)
- c.) Describe TWO lines of evidence which support the idea that the human population had its origins on the African continent. (4)

### Question 3

(Adapted from Life Sciences for All, Grade 12, Macmillan, Page 305)

- The percentages of female *Anopheles* mosquitoes that were resistant to an insecticide each year are shown in Table 4 below. In 2000 there was a maximum number of resistant mosquitoes. The other numbers are percentages of the maximum.

Table 3

| Year                 | 1996 | 1997 | 1998 | 1999 | 2000           |
|----------------------|------|------|------|------|----------------|
| Resistant mosquitoes | 4%   | 25%  | 50%  | 90%  | Maximum Number |

- A new insecticide was used in 1996 and killed most of the mosquitoes. Only 4% of mosquitoes had genetic resistance to the insecticide.
- a.) Explain why the number of mosquitoes resistant to the insecticide increased annually. Use natural selection theory to explain this.
- To help you: The resistant mosquitoes are the individuals best adapted to the new environment (containing insecticide). Their adaptation is due to a mutation and is genetically inherited. Female mosquitoes each lay a large number of eggs.

- b.) What happened to the non-resistant mosquitoes in 1996 when they were sprayed with insecticide in every home?
- c.) In 1997, were there a few non-resistant mosquitoes, or a lot? Why?
- d.) Do mosquitoes resistant to insecticide carry the malaria parasite?
- e.) Would you expect the number of people who died of malaria to decrease or to increase between 1996 and 2000? Explain why.

#### Question 4

(Adapted from *Life Sciences for All, Grade 12, Macmillan, Activity 6.8, Page 308*)

Study the diagram and answer the questions

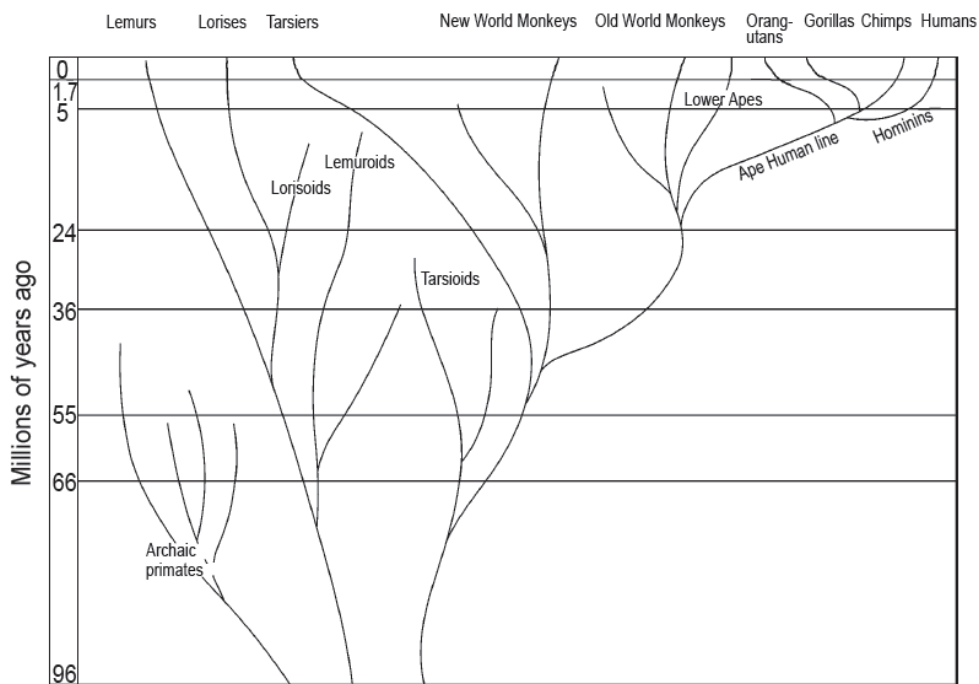


Diagram of primate evolution. It is based on fossils of extinct primates. The hominin line of evolution was separate from the lineages that led to modern apes.

- a.) Which living primate species is our closest relative?
- b.) Are we descended from this living primate species?
- c.) How long ago did we share an ancestor with this species?
- d.) Like humans, apes have no tails. When do you think this trait might have evolved?  
Before or after the ape lineage split away from the human lineage?

#### Question 5

(Adapted from Free State resources)

The incomplete table on the next page represents famous scientists, the fossil they discovered and the countries and the dates of discovery.

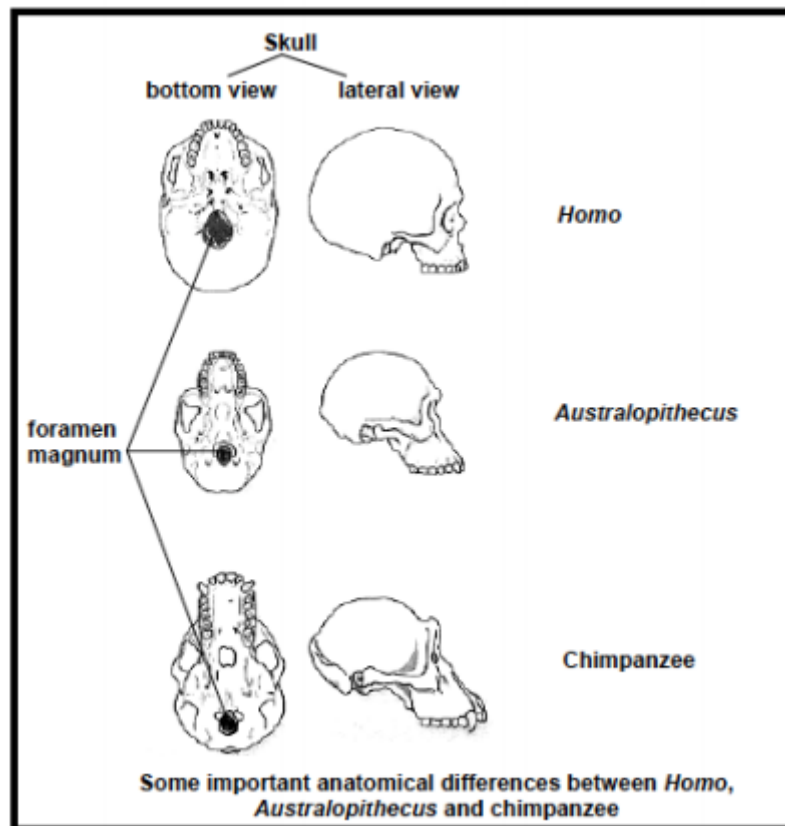
- a.) The Great Rift Valley is seen as the cradle of humankind, provide a reason for this. (2)
- b.) From the list above mention the fossils discovered at the Great Rift Valley. (3)
- c.) Explain the significance of these findings. (6)

| Scientist    | Fossil              | Place of discovery | Year of discovery |
|--------------|---------------------|--------------------|-------------------|
| 1            | Toumai              | 2                  | 2001              |
| Raymond Dart | 3                   | Sterkfontein caves | 4                 |
| Robert Broom | 5                   | 6                  | 7                 |
| 8            | Lateoili footprints | 9                  | 10                |
| 11           | 12                  | 13                 | 1994              |
| 14           | Karabo              | 15                 | 2008              |

### Question 6

(Adapted from Feb/Mar 2009, DOE, Paper 2)

A comparison of the anatomical features of organisms has helped scientists to propose evolutionary relationships.



- Tabulate FOUR observable differences between the side view of the skulls of *Homo* and the chimpanzee. (4)
- Which ONE of the organisms (*Australopithecus* or chimpanzee) is/was a quadruped? (1)
- Give ONE observable reason for your answer to QUESTION (b.). (1)

### Question 7

- Explain what is meant by the "Out of Africa" hypothesis. (3)
- Explain how mitochondrial DNA and Y DNA contribute to the above mentioned theory. (6)