



SUBJECT and GRADE	Life Sciences Grade 12	
TERM 2	Term 2 (Week 4)	
TOPIC	Evolution (Evidence of common ancestors for living hominids, including humans, Out of Africa hypothesis)	
AIMS OF LESSON	<p>At the end of this lesson you should be able to:</p> <ul style="list-style-type: none"> • Interpret a phylogenetic tree to show the place of the family <i>Hominidae</i> in the animal kingdom • Know the characteristics that humans share with African apes • Know the anatomical differences between African apes and human with the aid of diagrams • Know the lines of evidence (fossil evidence, genetic evidence and cultural evidence) that support the idea of common ancestors for living hominids including humans • Know the evidence (fossil and genetic evidence) for the 'Out of Africa' hypothesis 	
RESOURCES	Paper based resources	Digital resources
	<p>Refer to:</p> <ul style="list-style-type: none"> • Your textbook sections on human evolution • Pages 72 to 82 in your Mind the Gap Study Guide 	<p>Click on links below to download online resources on this topic/s:</p> <p>Refer to pages 19-22 in the Grade 12 Telematics learner workbook 2016: https://drive.google.com/file/d/17qzbJGZXTm7VNDzAfe59wpkj-WGN2wAc/view?usp=sharing</p> <p>Refer to PowerPoint slides on human evolution: https://drive.google.com/file/d/1FvxxXDtxB_HaoPMdXk1Cc2-NWULRAElt/view?usp=sharing</p> <p>Refer to anatomical differences between African apes and humans: https://drive.google.com/file/d/1rUxWBWFDcDni5baGrv3YaYa7FS_jlhuP/view?usp=sharing</p>
INTRODUCTION	<ul style="list-style-type: none"> • You have studied Darwin's theory of evolution by natural selection in lesson 1. • You had to differentiate between a species and a population in lesson 1. • You have studied the human skeleton in Grade 10. 	



CONCEPTS AND SKILLS

Study the following definitions. (Note that at least 2 marks are awarded if you can define a term correctly in the examination)

Hominidae - The family to which humans belong

Out of Africa hypothesis - The hypothesis which supports migration of human ancestors from the point of origin

Speciation – The evolutionary process during which new species form

Foramen magnum – The opening in the skull through which the spinal cord enters

Bipedalism - The ability of an organism to walk on two legs

Australopithecus – The genus of the fossil 'Little Foot'

Homo habilis – The first Homo species to use tools

Extinction - The permanent disappearance of a species from earth

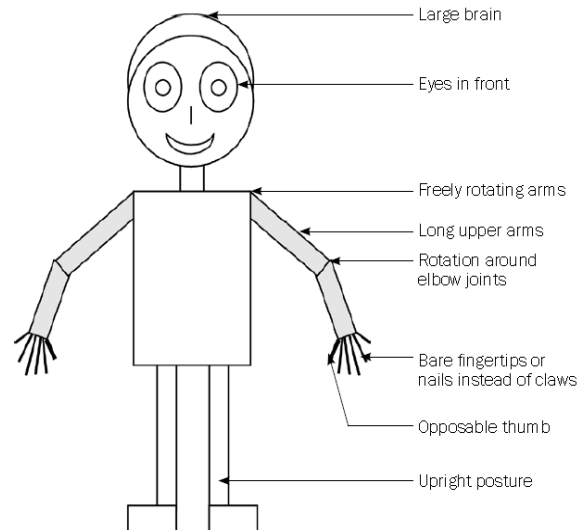
Phylogenetic tree - A diagrammatic representation of possible evolutionary relationships amongst species

Know the meaning of instructional verbs in test and examination questions e.g.

Instructional verb	Meaning
Name	Give the name of something
Differentiate	Use differences to qualify between two or more categories
Tabulate	Draw a table and indicate the answers as direct pairs.
Describe	State in sentences the main points of a process
Explain	Give your answer in a cause-effect or statement and reason sequence
Compare	Give similarities and differences between concepts



Characteristics that humans share with African apes:



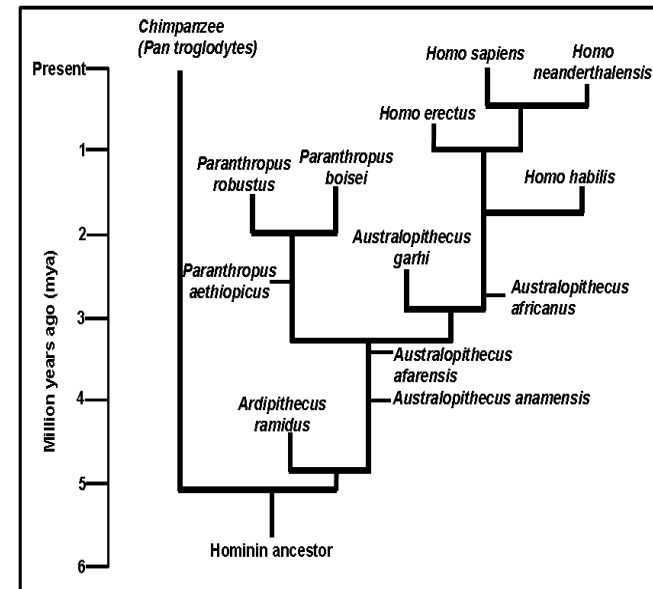
Differences between humans and African apes:

Feature	Humans	African apes
Foramen magnum	Foramen magnum in a forward position	Foramen magnum in a backward position
Cranium	Larger cranium size	Smaller cranium size
Spine	More curved/S-shaped	Less curved/C-shaped
Teeth	Smaller teeth/canines	Larger teeth/canines

Answer the following questions:

Question 1:

The diagram below shows possible evolutionary relationships among some hominids.



- 1.1 What is this type of diagram called?
- 1.2 How many of EACH of the following are represented in the diagram:
 - (a) Genera
 - (b) *Homo* species
- 1.3 Name the species that have *Paranthropus aethiopicus* as a common ancestor.
- 1.4 When did
 - (a) *Ardipithecus ramidus* become extinct
 - (b) *Homo erectus* first appear



Jaws	Less protruding jaws/non-prognathous	More protruding jaws/prognathous
Palate shape	Small and semi-circular	Long and rectangular
Cranial ridges	No cranial ridges	Cranial ridges across the top of the cranium
Brow ridges	Brow ridges less pronounced	Brow ridges pronounced

Out of Africa hypothesis:

All modern humans/*Homo sapiens* originated in Africa and migrated to other parts of the world.

Evidence for 'Out of Africa' hypothesis:

Fossil evidence:

- Fossils of *Ardipithecus* were found ONLY in Africa/Rift Valley/Ethiopia/South Africa
- Fossils of *Australopithecus* were found ONLY in Africa/Rift Valley/Ethiopia/South Africa
- The fossils of *Homo habilis* were ONLY found in Africa
- The OLDEST fossils of *Homo erectus* were found in Africa
- The OLDEST fossils of *Homo sapiens* were found in Africa

1.5 *Name* the Hominid species that existed at the same time as *Homo sapiens*.

Question 2:

Read the passage below.

NEW HOMININ SPECIES DISCOVERED
<p>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.</p> <p>The fossils were classified as a new species, <i>Homo naledi</i>. The physical characteristics of <i>H. naledi</i> are described as having traits similar to the genus <i>Australopithecus</i>, mixed with traits more characteristic of the genus <i>Homo</i>. It appeared that <i>H. naledi</i> represented a transitional fossil.</p> <p>An analysis of <i>H. naledi</i>'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 <i>Homo</i>.</p> <p>Four skulls were discovered, each with approximately half the volume of modern human skulls. The <i>H. naledi</i> skulls are closer in cranial volume to the skull of <i>Australopithecus</i>, but the cranium structure is more similar to those found in the genus <i>Homo</i>.</p> <p>The teeth are much smaller than those of <i>Australopithecus</i> and similar to the teeth of modern humans.</p> <p style="text-align: right;"><small>[Adapted from https://humanorigins.si.edu/evidence]</small></p>

- 2.1 *Define* the term transitional fossil.
- 2.2 *Name* a characteristic from the passage that *Homo naledi* shared with both *Australopithecus* and *Homo*.
- 2.3 *State* ONE other characteristic from the passage that *Homo naledi* shared only with *Australopithecus*.
- 2.4 *Explain* TWO characteristics of a skeleton which are adaptations for bipedalism.
- 2.5 *Give* ONE possible reason why there was a change to smaller teeth in modern humans.
- 2.6 Fossils are used as one line of evidence for hominid evolution. *Name* TWO other lines of evidence



Genetic evidence:

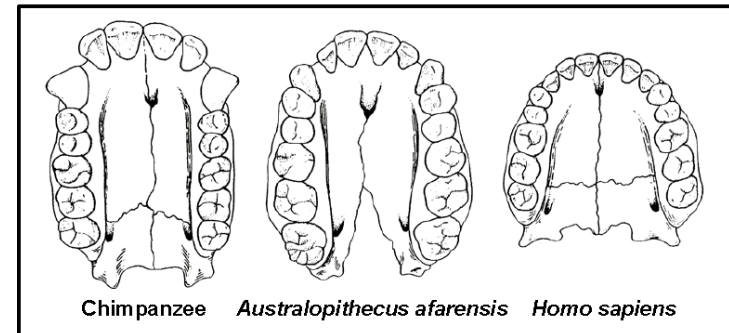
- Mitochondrial DNA is inherited only from the maternal line.
- Analysis of mutations on this mitochondrial DNA shows that the oldest female ancestor was located in Africa and that all humans descended from her.

Common errors made by learners in examinations:

- Learners unable to interpret phylogenetic trees
- Learners unable to list similarities between humans and African apes
- Learners unable to identify OBSERVABLE differences from diagrams of skeletal parts of humans and African apes.
- Learners do not know what a 'transitional fossil' is.
- Learners do not know the 'Out of Africa' hypothesis

Question 3:

The diagrams below show the upper jaws of some fossils. These diagrams are drawn to scale.

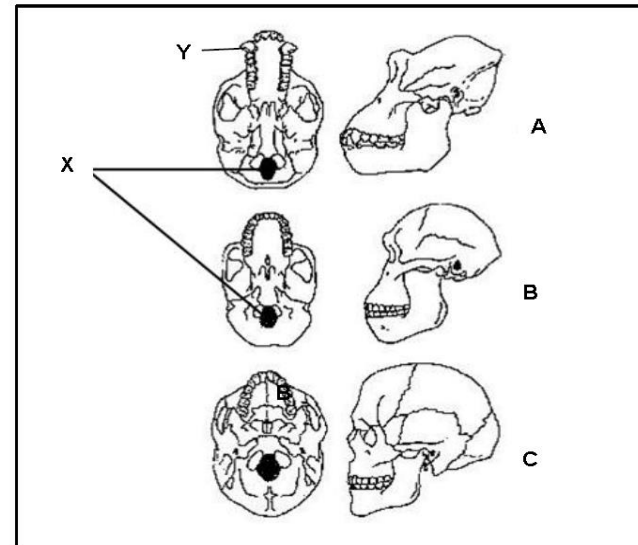


- 3.1 Describe ONE visible difference between the jaw of a chimpanzee and that of *Homo sapiens* which show trends in human evolution.
- 3.2 Based on the differences in dentition, what conclusion can be made about the change in diet from *Australopithecus afarensis* to *Homo sapiens*?
- 3.3 *Australopithecus* may be described as a transitional species between the chimpanzee and **Homo sapiens**.
- (a) Define a transitional species.
- (b) Use ONE visible feature of the jaw to explain why *A. afarensis* may be described as a transitional species.



Question 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).



- 4.1 *Label* part **X** and the type of teeth at **Y**.
- 4.2 *Explain* the significance of the location of structure **X** in organism **C**.
- 4.3 Which of the skulls (**A**, **B** or **C**) belongs to:
 - (a) An *Australopithecine*
 - (b) A quadrupedal primate
- 4.4 *Explain* how the change in the skull from **B** to **C** could indicate a change in intelligence.
- 4.5 *Tabulate* TWO observable differences, other than those mentioned in QUESTIONS 4.2 and 4.4, between skulls **B** and **C** that represent trends in human evolution.



ACTIVITIES/ASSESSMENT	<ul style="list-style-type: none">• Complete the activities/questions on the sections of human evolution in your textbook.• Work through the questions and activities on page 74 - 82 of your Mind the Gap Study Guide
CONSOLIDATION	<ul style="list-style-type: none">• Define all the terminology relevant to the topic/s covered in this lesson• Identify the similarities and differences between humans and African apes from diagrams• Work through the questions on human evolution in past examination papers
VALUES	<p>Scientific knowledge and understanding has been developed over time by people who were curious and who persevered with their quest for knowledge. Scientific knowledge is dynamic and can change over time.</p> <p>Conduct research on the various career opportunities in the field of 'evolution' e.g. palaeontology, palaeonthropology etc.</p>