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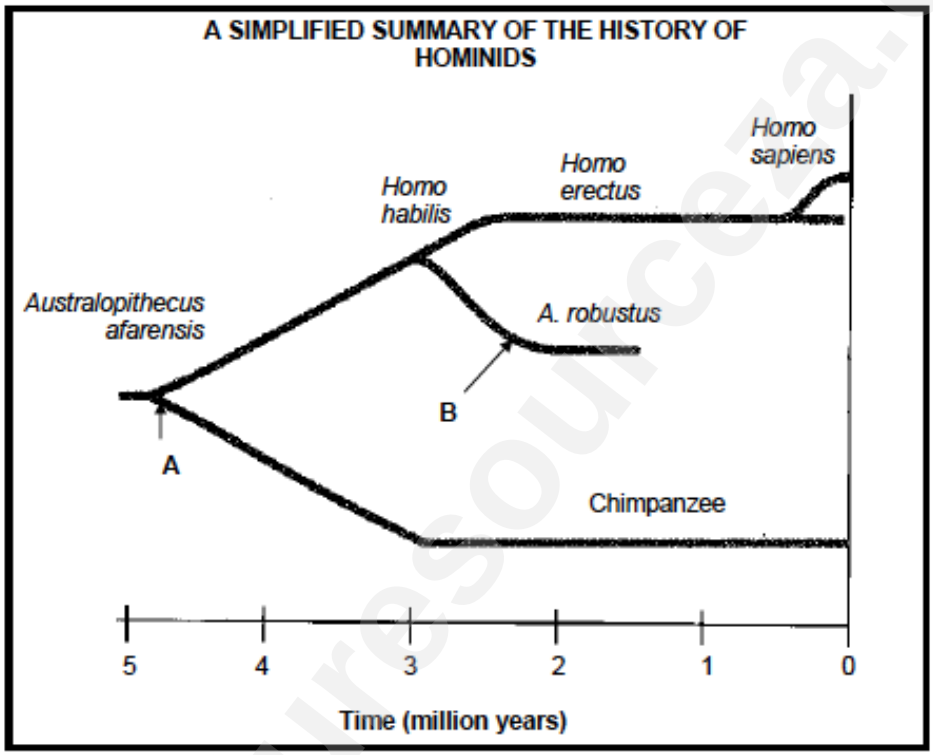
DIVERSITY: CRADLE OF HUMANKIND

Learner Note: Ensure that you know about the Cradle of Humankind, Genetic Eve, Mrs Ples, Taung Child, Little Foot, adaptive radiation and the Out-of-Africa and Multi-regional hypotheses.

SECTION A: TYPICAL EXAM QUESTIONS

Question 1: 13 minutes *(Taken from DoE Additional Exemplar 2008 Paper 2)*

During the study of the fossil records the following timeline of hominids were constructed. Study it and answer the questions that follow.



1.1. How many million years ago did the hominid group split (at **A**) into two groups? (1)

1.2. What is the main characteristic that caused the hominids to split into two separate groups at **A**? (1)

1.3. Which organism is thought to be the immediate ancestor of *A. robustus*? (1)

1.4. What are the common names of TWO *Australopithecus* species fossils that were discovered in South Africa? (2)

1.5. List FOUR characteristics that primates and humans have in common. (4)

1.6. Scientists accept the theory that the dinosaurs became extinct as a result of a comet or an asteroid striking the earth. Describe how this event could have led to the extinction of the dinosaurs. (5)

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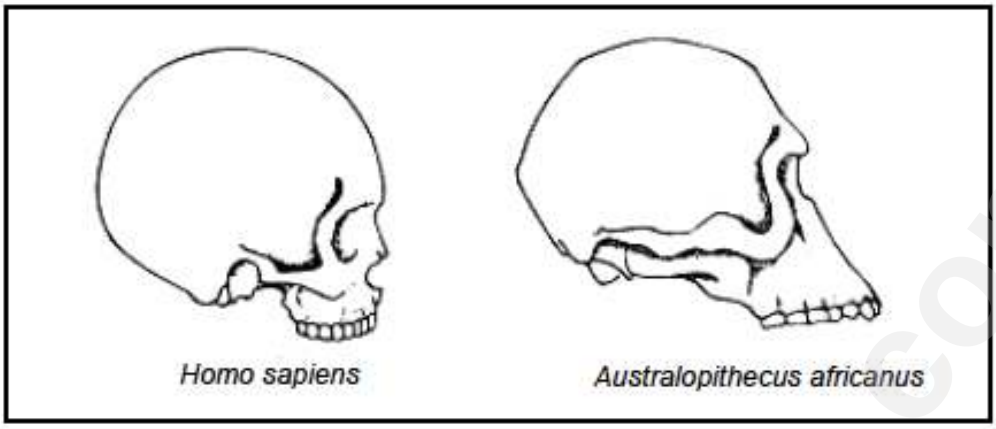
Question 2: 10 minutes *(Taken from DoE Feb/March 2010 Paper 2)*

Study the two skulls on the next page (drawn to the same scale) and answer the questions that follow.



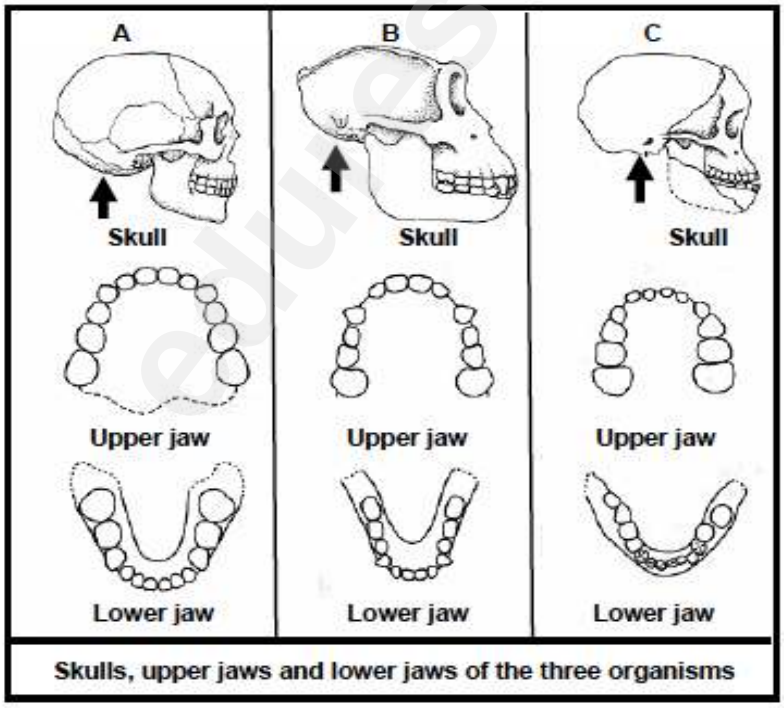
2.1. Tabulate THREE visible differences from the two skulls shown above that scientists have used to differentiate between Homo sapiens and other primates. (7)

2.2. Give THREE examples of fossils of Australopithecus that were discovered in Southern Africa. (3)

2.3. Explain the importance of the discoveries of the skulls of Australopithecus in understanding the evolutionary development of humans. 2)

Question 3: 12 minutes *(Taken from DoE Exemplar 2008 Paper 2)*

The diagrams below represent the skull, the upper jaw and lower jaw of three organisms, the Taung child (*Australopithecus africanus*), a modern human (*Homo sapiens*) and a gorilla (*Gorilla gorilla*). The arrow indicates the position of the foramen magnum (the opening that allows the spinal cord to connect with the brain). Study the diagrams and answer the questions that follow.



Skulls, upper jaws and lower jaws of the three organisms

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3.1. Identify the organisms that are represented by each of A, B and C. (3)

3.2. Assuming that the diagrams were drawn to scale, name TWO observable differences between the skulls of organisms A and B. (4)

3.3. Which organism (A, B or C) represents a carnivore? (1)

3.4. Explain your answer to QUESTION 3.3 using features visible in the diagram. (2)

3.5. Name TWO organisms that are best adapted for walking on two legs rather than four legs, by looking at the position of the foramen magnum (indicated by the arrows). (2)

SECTION B: SOLUTIONS AND HINTS

Question 1:

1.1 4,6 – 4,8 □ million years ago (1)

1.2 Bipedalism□ (1)

1.3 *Australopithecus afarensis* □ (1)

1.4 -Little foot
-Mrs Ples
-Taung child **(any 2) (2) (Mark first TWO only)**

1.5 Bare finger tips□
Long arms □
Freely rotating arms □
Stereoscopic vision □
Eyes with cones (in addition to rods) □
Large brain compared to body mass □
Portions of brain centres that process information from hands and eyes enlarged □
Olfactory brain centres□
Few offspring □ **(Mark first FOUR only) (4)**

1.6.
-Formation of large clouds of dust □
-blocking out the sun□
-global cooling□
-stopping photosynthesis□
-no producers in food chains □
-food chains involving dinosaurs destroyed□
-causing extinction **(any 5) (5)** **[14]**

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Question 2:

2.1

	Homo sapiens	*A. africanus*
1	No prominent brow ridge	1 Prominent brow ridge present
2	Flat face	2 Prognathous face
3	More rounded skull	3 Less rounded skull
4	Teeth arranged on a gentle(round) curve /more rounded upper jaw	4 Teeth arranged in a less curved way /less rounded upper jaw
5	Smaller upper jaw	5 Larger upper jaw
6	Smaller cheekbone	6 Larger cheekbone
7	Deeper set eye sockets	7 Shallower set eye sockets

***(Mark first THREE only)* (3x2 + 1 for table) (7)**

2.2 Little foot
Mrs Ples
Taung child **(3) (Mark first THREE only)**

2.3 Foramen magnum of the australopithecine was towards the centre indicating that these were the first bipedal hominids on Earth OR Large jaws indicate a mainly vegetarian diet **(any 2) (2) [12]**

Question 3:

3.1 A - Modern human *(Homo sapiens)*
B - Gorilla (*Gorilla gorilla)*
C - Taung child (*Australopithecus africanus)* (3)

3.2.

Organism A	Organism B
Flat face✓	Protruding jaws✓
Chin prominent✓	Chin not prominent✓
Foramen magnum occurs towards middle of the skull✓	Foramen magnum towards the back of the skull✓
No central ridge on the cranium✓	Central ridge on the craniuml✓
Eye sockets in front of skull✓	Eye sockets on top, front part of the skull✓
Less pronounced eyebrow ridge✓	Pronounced eyebrow ridge✓

(Mark first TWO only)

3.3 B (1)
3.4 It has most developed canines (2)
3.5 A and C (2)
(Mark first TWO only)

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SECTION C: ADDITIONAL CONTENT NOTES

The Cradle of Humankind

The Cradle of Humankind (means place where humans first originated/came from) is a World Heritage Site first named by Unesco in 1999, about 50 km northwest of Johannesburg, South Africa. This site includes the Sterkfontein Caves, where the 2,3-million year-old fossil *Australopithecus africanus,* or commonly know as the famous Mrs Ples, was found in 1947 by Dr Robert Broom and John Robinson.

In 1924, the juvenile *Australopithecus africanus* skull, **Taung Child,** was discovered by Raymond Dart at a place called Taung in the North West Province. The uncovering of Mrs Ples provided further proof of the development of humankind, and supported the findings of the Taung Child.

In 1997, the near-complete *Australopithecus* skeleton **of Little Foot**, which dated back to 3.3 million years ago, was discovered at Swartkrans in the Cradle of Humankind. They also found evidence for the controlled use of fire dating back to 1 million years ago.

Hominids have been **excavated** at the Cradle of Humankind. Anthropologists believe that hominids lived all over Africa, but their remains are only found at sites where their bones were preserved into fossils. Archaeological caves in the **Makapan Valley** show traces of human occupation and evolution dating back some 3,3 million years. The fossils show several specimens of early hominids dating back to between 4,5 million and 2,5 million years.

Scientists and anthropologists have theorised about where Homo erectus came from. Competition for food and space causes organisms to move away from set groups and spread out. So, over time, the organisms adapt to their new environments and change. This is called **adaptive radiation**. The **Multi-regional hypothesis** maintains that all modern humans originated from the Homo erectus species that left Africa over a million years ago, and that the development of Homo sapiens was not restricted to one region but all over the world. The **Out of Africa hypothesis** maintains that all modern humans evolved in Africa and from here, they spread out to the rest of the world.

Evolutionary Scientists generally agree that humans have one common ancestor that is called **Genetic Eve**. DNA tests have suggested that the human DNA tree has its roots in Africa and originated from Genetic Eve whom they calculate to have lived almost 200 000 years ago.

Population Movement

Population Movement in Prehistoric Times

Anthropologists and Palaeontologists have evidence proving that humans moved from Africa to Europe during the glacial period, and devised the **African Hypothesis**. Some underwent a process of bleaching, resulting in fair-skinned, light-eyed and blonde-haired people of Britain, Scandinavia and Germany. This theory and fossil evidence contradicts the theory that humankind originated in Asia. The oldest centres of civilisation discovered, are located in Egypt, Mesopotamia and the Indus basin.

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Modern Population Movement

Many studies have been conducted to show the **results of overcrowding**. In many species, natality (birth rate) decreases and mortality (death rate) increases as the population density increases. **Social aggression** results in a fight for food and survival. **Fecundity** (the ability of a mature female to produce eggs that are fertile) decreases with the stress, resulting in females miscarrying or not producing fertile eggs. Diseases are transmitted rapidly within an overcrowded community.

Population growth is one of the major problems humans have to face and is a direct result increased birth rate and decreased death rate. Factors that threaten survival are:

- **Maldistribution of resources** and inefficient use of natural resources. If the human population continues to increase at the present rate, natural resources will soon become exhausted.
- **Environmental resistance** refers to the limiting factors both biotic and abiotic, that prevent organisms from surviving and reproducing. As the environment is abused and destroyed, environmental resistance results, as the environment can no longer sustain life. There is not enough food, water, shelter and space, so the population decreases as the death rate increases.
- **Poverty and hunger** is increasing at an alarming rate as the population exceeds the food supply, resulting in competition within populations.

SECTION D: HOMEWORK

Learner Note: As you attempt attempt the homework, you MUST stick to the time frames. If you get stuck refer to either the additional notes or your class teacher.

Question 1: 5 Minutes

1.1. Why is the Cradle of Humankind World Heritage site an area that is regarded as universally valuable? (1)
1.2. In which Hominid type would we place the Taung child and Little Foot. (2)
1.3. Describe the 'African Hypothesis'. (2)

Question 2: 6 Minutes

The size of the cranial cavity is used to estimate the size of the brain. The size of the brain is used to roughly indicate intelligence. The table below shows the brain size of apes and humans.

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Name of living or fossil primate	Cranial capacity (in mm^3)
Modern apes	
Gibbon	100
Orang-utan	395
Chimpanzee	400
Gorilla	510
Australopithecines	
Early forms	450
Late forms	660
Early humans	
Java man	870
Peking man	1050
Neanderthal man	1450
Modern humans	
Cro-Magnon man	1660
Living man	1450

The early Australopithecines lived about 3 million years ago and the late Australopithecines about 1,7 million years ago. It took about one million years for the size of the human brain to double.

2.1. What is the size difference between the brain of Living man and Java man? (1)

2.2. Which early humans had the same size brain as Living man? (1)

2.3. Think of possible reasons why Cro-Magnon man, who lived during the Stone Age, had a larger brain than Living man. (2)

2.4. Which of the Australopithecines had a brain size more or less the same size as the modern apes? (1)

2.5 What type of person would have dug up and studied the different types of skulls in order to record the size of the brain? (1)

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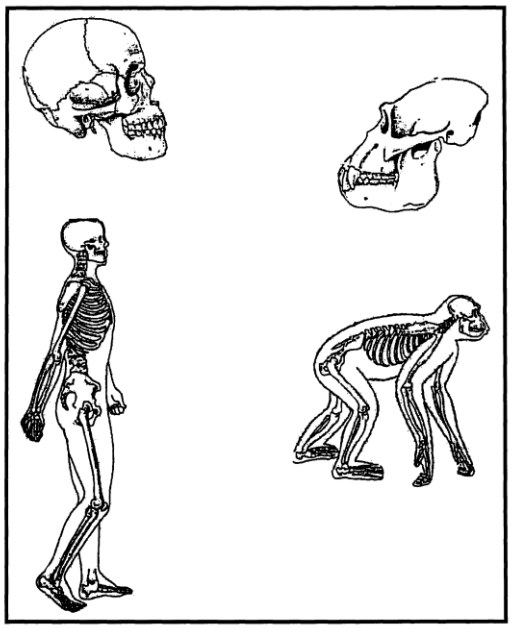
Question 3: 18 Minutes *(Taken from GDE Preparatory Examination 2009 Paper 2)*

Study the pictures below on the parts of the skeletal structures of primates and answer the questions that follow:



3.1. State ONE reason why apes and humans are referred to as 'hominids'. (2)

3.2. Name the term used to describe the locomotion of

a) humans (1)

b) chimpanzees (1)

3.3. Suggest TWO ways in which locomotion of modern humans will be disadvantaged if they had the skeletal structure of apes and chimpanzees. (2)

3.4. Distinguish between the skeletal structure of man and the chimpanzee, other than those mentioned in Question 3.3. (**5 x 2)** (10)

3.5. Predict the shortcomings (challenges) the ape would experience if it had the phalanges of *Homo sapiens*. (2)

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SECTION E: SOLUTIONS TO SESSION 25 HOMEWORK

Question 1:

1.1

HUMAN	CHIMPANZEE
Foramen magnum more central / in the middle/ Spinal cord exits underneath skull √	Foramen magnum at back of skull /Spinal cord exits at the back of skull √
Rounded / bigger skull √	Narrower / smaller skull √
Small canines √	Large canines √
No gap between teeth √	Gaps between teeth √
Dental arch /teeth arrangement more rounded √	Dental arch / teeth arrangement more rectangular √
Pelvis wide/ bowl shaped √	Pelvis tall / narrow √
Sacrum bigger / shorter √	Sacrum longer / narrow √

Any 4 x 2 Tabulate √ +1 (9)

1.2 Human √ and Australopithecus √ (2)

1.3 The foramun magnum of both Human and Australopithecus is placed in the middle of the skull √ adaptation for upright walking/bipedalism √ (2)

1.4 Human has larger skull √√/brain than Australopithecus / rounder skulls **Any 1 x 2 (2)**

2.

Anthropology	**Palaeontology**	**Archaeology**
Is the study of the human race, including the different belief systems, customs and social habits. ✓✓	Is the study of the earliest known periods of human existence, for example the Stone Age. ✓✓	Is the study of ancient times by examining the buried remains of buildings, tool and animal and plant fossils. ✓✓

3.
- Australophithecus afarensis✓
- Australophithecus africanas✓
- Australophithecus rubustus✓
- Homo habilis✓
- Homo erectus✓
- Homo sapiens✓

The formation and development of the skull varies because the brain capacity increased as the mass of the brain tissue increased. ✓

4.
- the hands became free for carrying food, tools and babies✓
- a better view of the surroundings in search of food and predators✓
- movement from place to place becomes more efficient✓

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- faster cooling of the body, as an increased surface area is exposed to the air - which was essential in their original hot tropical environments✓
- display of the male sex organs as part of courtship behaviour✓

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