



NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2018

LIFE SCIENCES: PAPER I

Time: 3 hours

200 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 14 pages and a yellow Answer Booklet of 14 pages (i–xiv). Please check that your question paper is complete. Detach the yellow Answer Booklet from the middle of the question paper. Remember to write your examination number in the blocks provided.
 2. This question paper consists of four questions.
 3. Question 1 must be answered in the yellow Answer Booklet provided. Questions 2, 3 and 4 must be answered in your Answer Book.
 4. Start **each question** on a **new** page.
 5. Read the questions carefully.
 6. Number the answers exactly as the questions are numbered.
 7. Use the total marks that can be awarded for each of Questions 1, 2, 3 and 4 as an indication of the detail required.
 8. It is in your own interest to write legibly and to present your work neatly.
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QUESTION 2

- 2.1 Read the article below. Use the information in the text and your own knowledge to answer the questions that follow:

In 1924 Raymond Dart examined a fossil of a skull found in a limestone quarry at Taung, a small town situated in the North West Province of South Africa. After more than a month of patient chipping, he managed to reveal the skull's face. Its cranial capacity was 405 cm³.

Dart with the Taung Child

[Source: <<https://en.wikipedia.org>>]

He judged the skull to be that of a juvenile (young) individual and it came to be known as the Taung Child. Dart was convinced even then that he had made the "early human find" of the century.

In a paper published in the journal *Nature*, he argued that the Taung Child represented a missing link between apes and humans since it combined humanlike teeth and upright posture with a small cranial capacity.

However, the global scientific community were very critical of Dart's theory due to its belief that humans originated in Europe. The discovery in England of another fossil known as Piltdown Man in 1912 supported this view that humans originated in Europe. Its large braincase and apelike jaw and teeth were exactly what these scientists expected to find from a "missing link".

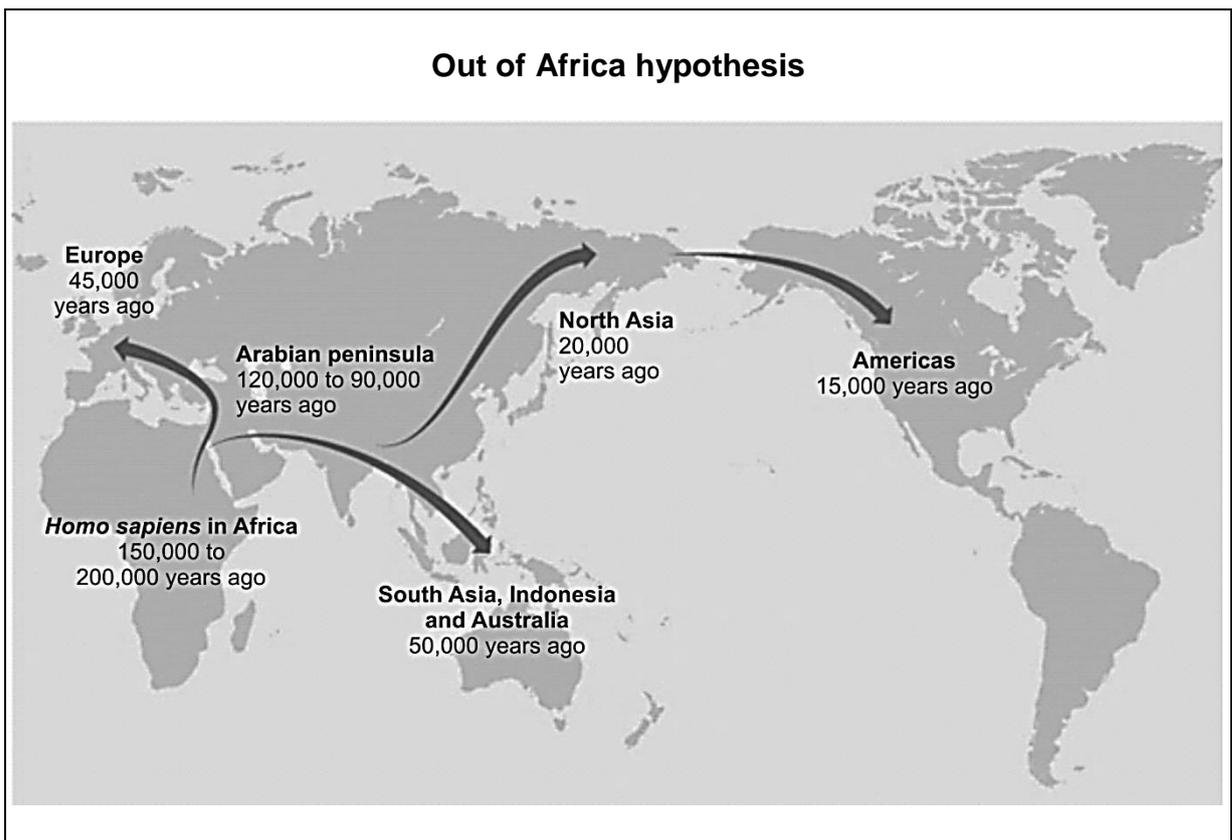
Piltdown Man was revealed to be a hoax in 1953 when scientists at the University of Oxford in the United Kingdom, using the then-new technique of fluorine dating revealed that Piltdown Man's bones were not all the same age. Further analysis revealed they were a combination of carefully carved and stained human and ape bones.

[Adapted: <<http://www.sciencemag.org>> and <<http://www.macroevolution.net>>]

- 2.1.1 Provide the scientific name of the Taung Child. (1)
- 2.1.2 Dart was able to determine from the skull that it had an upright posture. What feature of the skull would indicate it was bipedal? (2)

- 2.1.3 Explain THREE advantages that bipedalism would provide for a hominid such as the Taung Child. (3)
- 2.1.4 State TWO ways in which the teeth of an ape differ from the human-like teeth of the Taung Child. (2)
- 2.1.5 Suggest how Dart was able to determine the cranial capacity of the Taung Child. (2)
- 2.1.6 How did the discovery of Piltdown Man contradict Dart's theory that the Taung Child was a missing link between apes and humans? Provide TWO ways. (2)
- 2.1.7 The scientists made an error in not considering Dart's proposal. Discuss how this example could lead to better practices in the scientific community. (4)

2.2 The latest research suggests that modern humans, *Homo sapiens*, originated in Africa. *Homo sapiens* then dispersed to other regions as shown in the map below. This is known as the Out of Africa hypothesis.



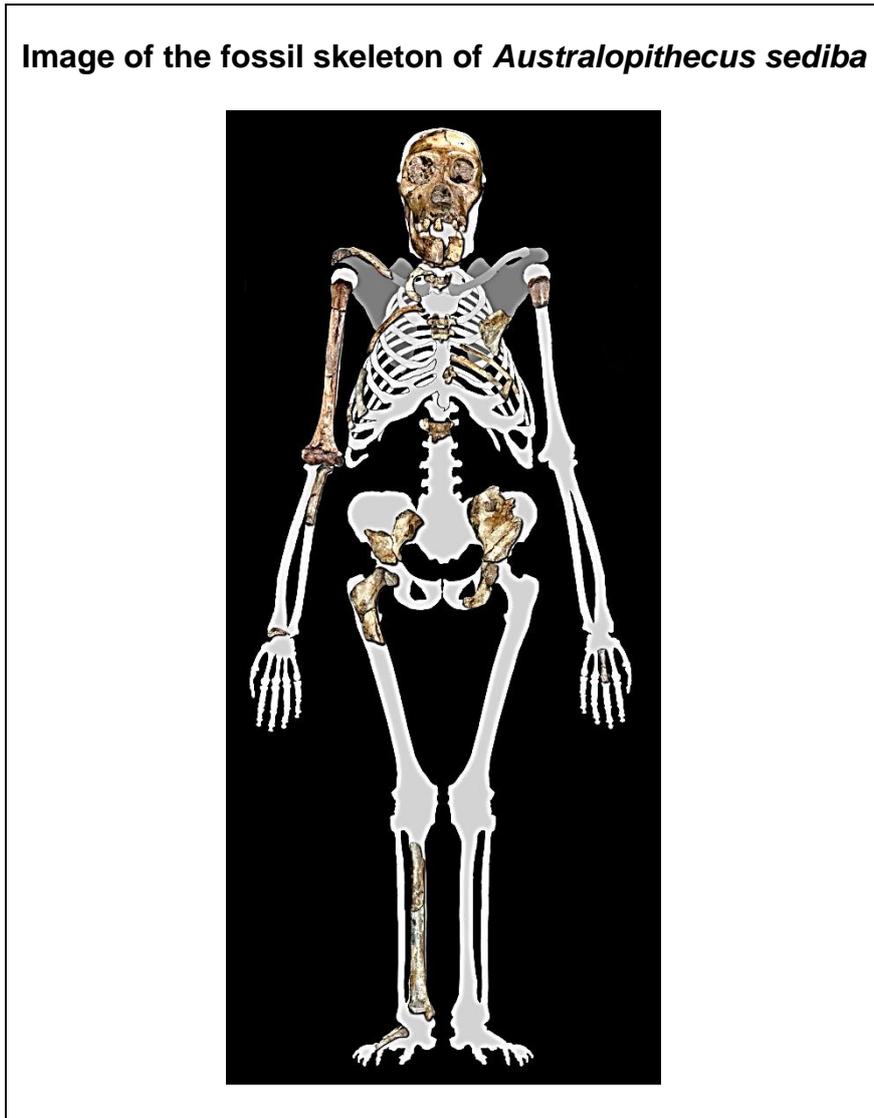
[Source: <<https://www.sciencenews.org>>]

- 2.2.1 Explain TWO lines of evidence that scientists have used to support this hypothesis. (4)
- 2.2.2 If *Homo sapiens* left Africa 200 000 years ago, calculate how long it took them to migrate to Europe. Show all working. (2)

2.2.3 Discuss TWO characteristic features of *Homo sapiens* that enabled them to survive in new and unpredictable environments. (4)

2.2.4 Briefly outline the alternative hypothesis that describes how modern humans spread across the world. (2)

2.3 *Australopithecus sediba* was discovered in August 2008 by Professor Lee Berger and his son. The announcement of its discovery was only made to the public in April 2010.



[Adapted: By Prof Berger – Own work, CC BY-SA 3.0]

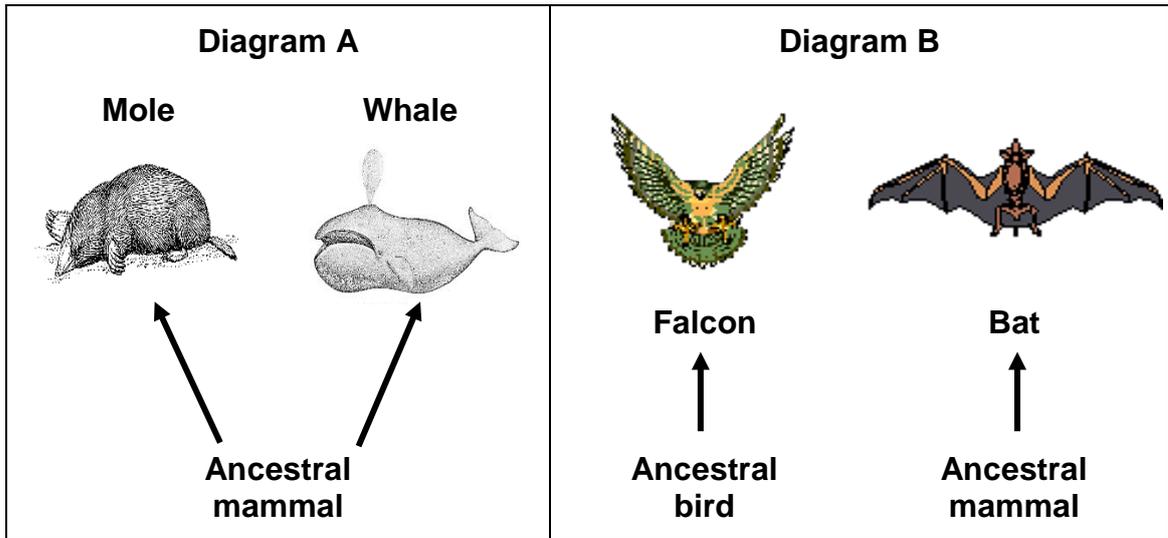
2.3.1 Where in South Africa was this fossil discovered? (1)

2.3.2 Suggest TWO possible reasons for the gap in time between the date of discovery and the date on which its discovery was made public. (2)

2.3.3 Explain one significance of the discovery of *Australopithecus sediba* to our understanding of human evolution. (2)

2.3.4 State one social or economic benefit to South Africa of the discovery of this fossil. (1)

2.4 Study the diagrams A and B below. They illustrate the concepts of convergent and divergent evolution.



[Adapted: <<https://www.wpclipart.com>>]

[Adapted: <<https://sites.google.com>>]

Match the diagrams A and B to each type of evolution and explain why it is an appropriate representation.

(6)
[40]

QUESTION 3

- 3.1 Read the article below and use the information in the text and your own knowledge to answer the questions that follow:

The construction of a dam in central Brazil has resulted in fast evolution of lizards in the region. In just 15 years, the lizards' heads have grown larger—an adaptation that allows them to eat a range of termites of different sizes.

In 1996, the dam flooded a series of valleys in Brazil creating nearly 300 islands out of what was once high ground. The hilltops that became islands were once home to a variety of lizards that eat termites. Many of the area's largest lizard species disappeared from the new islands, probably because there wasn't enough food to support their energy needs. But a small, dragonfly-sized lizard called *Gymnodactylus amarali* (a termite eater once common across the flooded area) was able to survive. Larger termites, which had previously been eaten by the larger lizards, were now available to these lizards.

But there was a problem: the lizards had small heads, only 1 cm wide, and some of the termites were nearly the same size. However, some of the individual lizards were lucky enough to have slightly larger heads and were able to eat the termites.

When scientists compared the island lizards with their mainland relatives—separated by only 15 years and a short stretch of water—the researchers found the island lizards had heads that were about four percent larger.

Image of *Gymnodactylus amarali*



[Source: <<http://theconversation.com>>]

[Adapted: <<http://www.atlasobscura.com>>]

- 3.1.1 When the dam flooded the valleys, why were the larger lizard species unable to survive on the newly formed islands? (1)
- 3.1.2 What type of competition existed between the larger lizard species and *Gymnodactylus amarali*? (1)
- 3.1.3 Using the theory of natural selection, explain how the lizards with larger sized heads were able to evolve in 15 years. (5)
- 3.1.4 Could the island lizards be regarded as a different species to the mainland lizards? Explain your answer. (2)

3.1.5 Is the change in lizard head size an example of macroevolution or microevolution? Explain your answer. (3)

3.2 Read the article below. Use the information in the text and your own knowledge to answer the questions that follow:

Swertia chirayita is a medicinal herb that grows at high altitudes in India. The herb is used by indigenous population groups in many ways for medicinal purposes, e.g. the treatment of hepatitis, inflammation and digestive diseases. Overuse in traditional medicine has resulted in the plant now being on the verge of extinction in the wild.

Scientists conducted an investigation using the seeds of the herb to determine their suitability for storage in a seed bank. They stored the seeds at three different temperatures: room temperature, 4°C and -15°C.

They also stored the seeds for different lengths of time. Scientists then measured the effect of both temperature and storage time on germination.

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

Graph showing the effect of temperature and storage time on the germination of *Swertia chirayita* seeds

Storage period (months)	Room temperature (%)	4°C (%)	-15°C (%)
0	100	100	100
5	85	95	85
10	65	80	70
15	50	65	55
20	35	50	45
25	20	35	30
30	0	0	15
35	0	0	0

▲ Room temperature
● 4°C
◆ -15°C

[Adapted: <<https://www.ncbi.nlm.nih.gov>>]

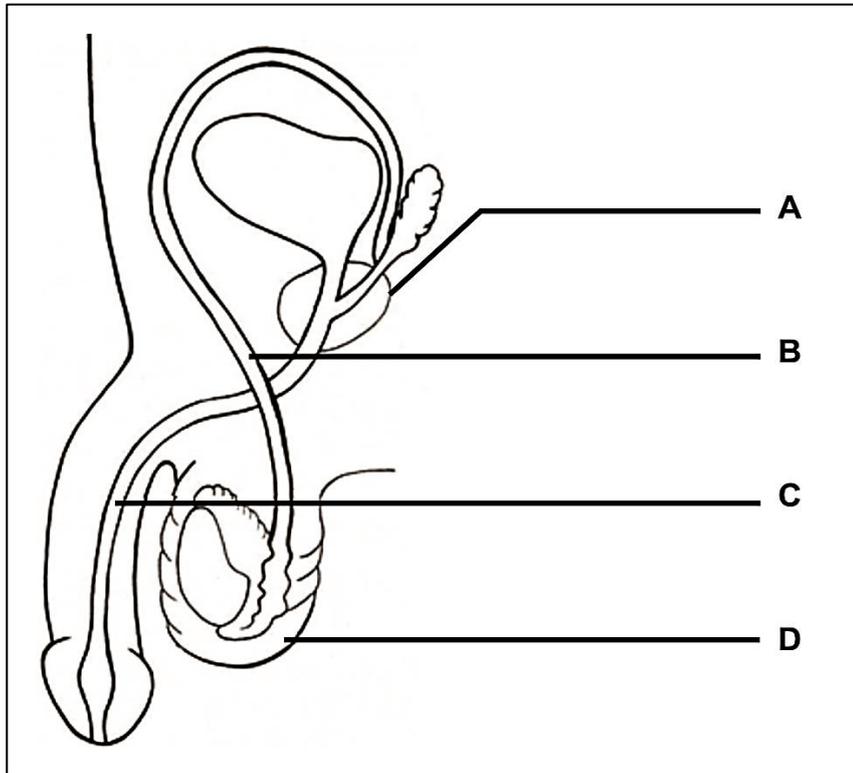
3.2.1 What was the highest percentage germination of the seeds? (1)

- 3.3.1 What difference is noted between the liver tissues of the patient and of the healthy subject? (2)
- 3.3.2 Why was a liver biopsy of the healthy subject also taken? (2)
- 3.3.3 (a) Which hormone is responsible for the storage of glycogen in the liver? (1)
- (b) Use a flow diagram to explain the process of how glycogen comes to be stored in the liver. (7)
- 3.3.4 Two symptoms of the patient were an enlarged liver and abnormally low blood glucose. Use the micrographs on page 8 to explain a possible reason for each of the symptoms shown by the patient. (2)
- [40]**

QUESTION 4

4.1 Provide labels for structures A–D in the diagram below. (Write A–D in your Answer Book with the appropriate label.)

Diagram of male reproductive organs



[Adapted: <<http://anatomybody101.org>>]

(4)

4.2 Medical Male Circumcision (MMC) is the full removal of the foreskin performed by a qualified doctor or healthcare worker. MMC is offered free of charge from government clinics and hospitals.

4.2.1 Where on the body is the foreskin located?

(1)

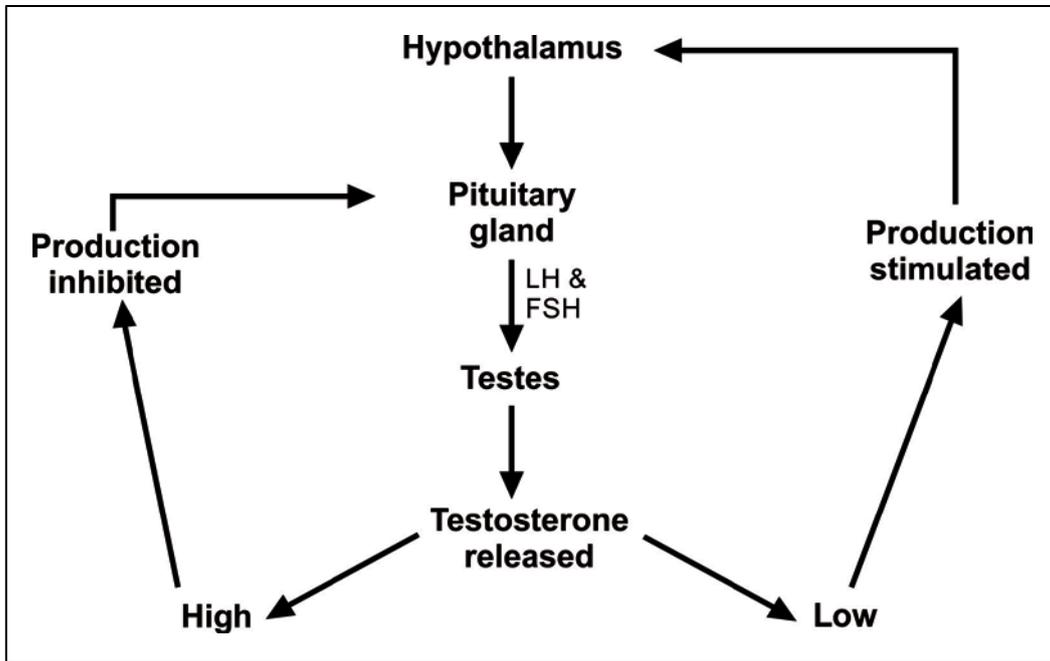
4.2.2 State whether the following statements regarding MMC are TRUE or FALSE.

- (a) Less chance of transmitting STIs to sexual partner.
- (b) Unlikely to become infected if performed in a hospital.
- (c) Leads to reduction in fertility in men.

(3)

4.3 The diagram below shows how the release of testosterone is controlled by negative feedback.

Diagram showing hormonal control of testosterone levels



[Adapted from: <<http://www.usapowerlifting.com>>]

4.3.1 Name the organ that secretes testosterone. (1)

4.3.2 State TWO functions of testosterone. (2)

4.3.3 Anabolic steroids contain synthetic forms of testosterone. Male athletes who take anabolic steroids may experience a decrease in fertility. Use the information provided in the diagram above to explain how this can occur. (5)

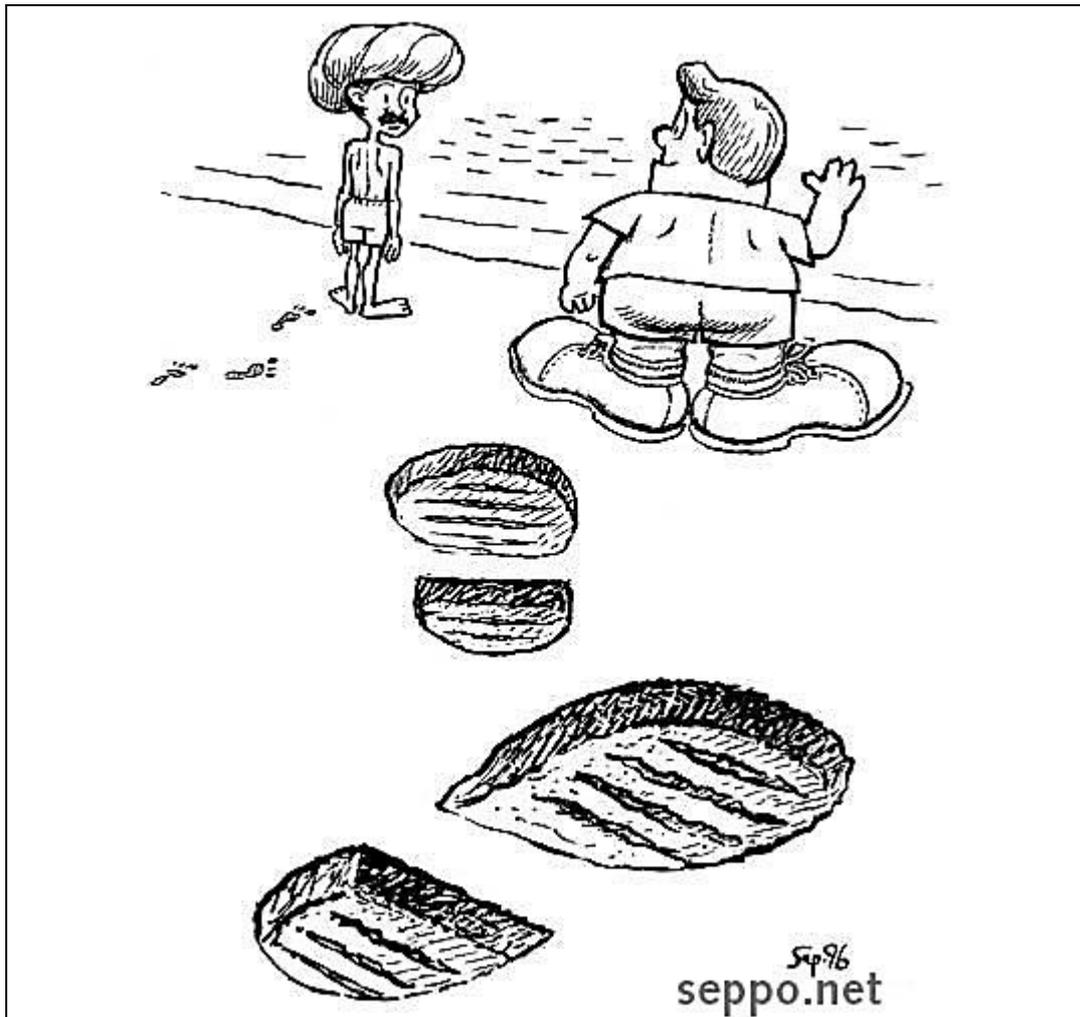
4.3.4 The following extract was taken from a news report.

Studies completed in South African schools indicated the high use of steroids by school boys. Nearly two thirds of male steroid users wanted "to look good" while just less than a third were taking steroids to improve sports performances. In the sporting context, pressure from coaches, peers and parents can be significant reasons for steroid use.

[Source: <<https://www.iol.co.za>>]

Provide THREE reasons why testing for steroids should be made compulsory for all school boys. (3)

4.4 How does the image below reflect an understanding of the ecological footprint of developed and developing countries?

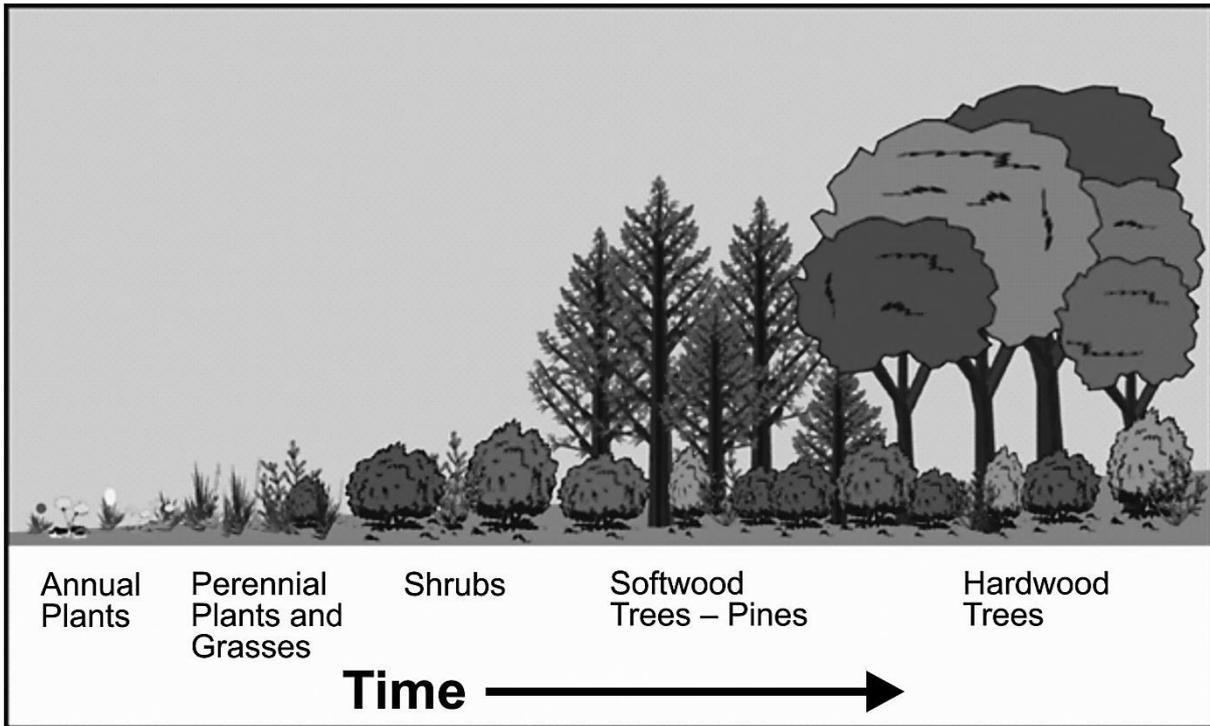


[Source: <<http://www.seppo.net>>]

(6)

4.5 A long term study of succession was conducted on abandoned agricultural crop fields. The first stage of succession was characterised by colonisation of annual plant species on bare ground and nutrient poor soils. These annual species had short lifespans (one growing season), rapid maturity, and produced numerous small easily dispersed seeds. The annuals were then quickly replaced in dominance in the next year by plants and grasses.

Diagram showing the succession of plant species on abandoned crop fields



[Source: <<http://www.physicalgeography.net>>]

- 4.5.1 (a) Identify the type of succession referred to in the text. (1)
- (b) Give a reason for your answer in Question 4.5.1 (a). (1)
- 4.5.2 Use the diagram to identify the type of plant present in the climax community. (1)
- 4.5.3 State TWO density dependent factors that would limit the population size of the plants in the climax community. (2)
- 4.5.4 Use the information provided in the text and your own knowledge to explain whether it is possible for agricultural land to be converted into a nature reserve to conserve wildlife. (3)

4.5.5 Study the table below and answer the questions that follow:

Table showing a comparison of plant, community and ecosystem characteristics between early and late stages of succession		
Characteristic	Early stages of succession	Late stages of succession
Plant life span	(i)	(ii)
Seed dispersal characteristics of dominant plants	Well dispersed	Poorly dispersed
Average plant size	Small	Large

[Adapted: <<http://www.physicalgeography.net>>]

- (a) Provide the term to describe the plants in the early stages of succession. (1)
- (b) Differentiate between the terms "community" and "ecosystem". (2)
- (c) The plant life span in the early stages and late stages of succession has not been filled in on the table. State what the life span should be for plants in both stages of succession at (i) and (ii). (2)
- (d) Plants in the early stages of succession have seeds that are well dispersed. Give TWO advantages of this characteristic. (2)
- [40]**

Total: 200 marks