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91606



Draw a cross through the box (X) if you have NOT written in this booklet

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Mana Tohu Mātauranga o Aotearoa  
New Zealand Qualifications Authority

## Level 3 Biology 2024

### 91606 Demonstrate understanding of trends in human evolution

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of trends in human evolution.	Demonstrate in-depth understanding of trends in human evolution.	Demonstrate comprehensive understanding of trends in human evolution.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**You should attempt ALL the questions in this booklet.**

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

Do not write in the margins (// // // //). This area will be cut off when the booklet is marked.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

**Excellence**

**TOTAL 19**



### QUESTION ONE: Movement of hominids and hominins

Chimpanzees find most of their food in trees, so they need to be able to climb and forage for food in an arboreal environment. They also need to be able to cover long distances of up to 5 kilometres per day between food spots. As a result, chimpanzees have a wide range of types of movement, both in the trees and on the ground. These include quadrupedal and bipedal walking. Research has found that the energy cost of bipedal and quadrupedal walking in the chimpanzee is quite similar. This similarity in energy cost suggests that carrying out bipedal walking would have had no effect on the energy costs for early hominin ancestors.

Habitual bipedalism, however, may have favoured changes of the hip to allow a more upright posture and the changes to the lower limbs that allowed for more efficient walking over long distances.



Chimpanzee with baby.



Modern human with baby.

Discuss factors relevant to quadrupedal movement and bipedalism.

In your answer, include discussion of:

- the terms habitually bipedal and arboreal, including descriptions ✓
- reasons for the differences between the modern human and the chimpanzee, related to the forms of the spine, pelvis, and valgus angle ///
- why modern humans are bipedal despite a named disadvantage of this characteristic. ///

An arboreal lifestyle is ~~one~~ living primarily in trees.  
A quadruped is suited to this arboreal lifestyle.

Chimpanzees are adapted to an arboreal lifestyle.  
~~They~~ Arboricism is living in trees. Chimpanzees  
use these trees as their primary food source,  
and are therefore adapted for climbing  
and swinging (brachiation) in this environment.  
Chimpanzees have a c-shaped ~~st~~ spine.



3 long arms

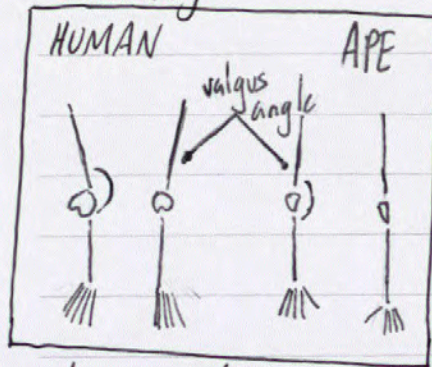
This adaption allows for brachiation, and quadrupedal movement. When walking quadrupedally, the C shaped spine helps to support the organs, and position the limbs. Chimpanzees have a long pelvis, in contrast to a human's short, bowl shaped pelvis. This is not adapted for walking bipedally <sup>but instead for walking quadrupedally</sup>. Chimpanzees do not have a valgus <sup>angle</sup> ~~and~~ adapted for walking bipedally. It is instead ~~st~~ fairly perpendicular to the ground when standing. This is suited to climbing and foraging in trees, and walking bipedally.

In contrast to chimpanzees, humans are habitually bipedal, meaning they walk on two legs <sup>habitually</sup>. Humans have an S-shaped spine, which is used to absorb shock when running and walking bipedally. It also helps put the centre of mass over the hips and legs, helping balance when walking. The chimpanzee's spine (C-shaped) is not adapted for this. Humans have a short, bowl shaped pelvis, which is strong and allows for tilting and rotating while walking. Again, this helps with balance. Humans have a valgus angle ~~and~~ adapted for walking bipedally. This angle helps balance, keeping centre of mass over the feet.

and birthing young.



and saves energy by eliminating wobble when walking.



There were many advantages to walking bipedally to our hominin ancestors.

As forested areas turned to grassland, resources were farther apart and not in trees. This required travelling long distances on foot. Walking bipedally was more efficient and saved energy.

Walking bipedally allowed early hominins to carry young, food, tools and resources, offering a survival advantage. Apes and quadrupeds do not have hands free to carry young and food, instead ~~for~~ young would ride on back, which is suited to the C-shaped spine. Walking bipedally allowed for more effective cooling in the warm climate as less skin was exposed to the sun. It also allowed hominins to see over tall grasses to spot food sources and predators. This again offered a survival advantage.

The bowl shaped pelvis is a disadvantage of walking bipedally, as child birth is very difficult and can result in death of both parties. Humans are bipedal despite this disadvantage, as the advantage of walking bipedally, and the energy saved from this pelvis shaped outweighed the costs.



## QUESTION TWO: Neanderthal fibre use

Neanderthals (*Homo neanderthalensis*) made many tools. Numerous examples of their Levallois stone tools have been discovered. They may well have used other material such as wood or fibre; however, these break down easily and do not fossilise, so are not preserved.

Recently, a stone tool was discovered with evidence of Neanderthals having used twisted fibre made from bark. The fibre was a 3-ply cord, with the fibres arranged as shown in the image below. This method of cord-making is still in widespread use today. Twisted fibres provided the basis for clothing, rope, bags, nets, mats, and boats – all of which, once discovered, would have become important parts of daily life. This evidence of understanding and use of twisted fibres shows us that Neanderthals had use of complex, multi-component technology, as well as a mathematical understanding of pairs, sets, and numbers.



Fragment of twisted cord with the yarn structure highlighted in colour.



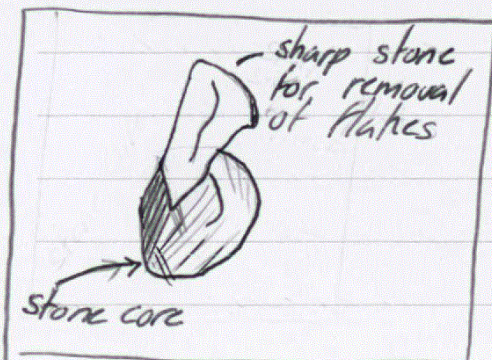
Ply confirms the number of yarns twisted together.

Discuss how the use of twisted fibres would have advantaged the Neanderthals.

In your answer, include discussion of:

- the Levallois technique ✓
- the endocranial region that would have developed, allowing for the understanding and use of mathematical rope-making ✓
- TWO explanations of how Neanderthal might have used tools, leading to an increase in health ✓
- a reason **how** and a reason **why**, with the benefit of twisted fibre for food gathering, Neanderthals were able to succeed in the cold, European climate. ✓

The Levallois method involves using a sharp stone or flake to punch down and ~~chip~~ <sup>shave</sup> off small flakes from a core. Both the core and the



flakes were used as tools. This developed method of making tools suggests significant development in the brain, allowing abstract thought,



communication, and imagination. The use of tools gave Neanderthals a survival advantage. They increased access to food, shelter and plants. Tools could have been used for hunting and killing prey (hand axe or spears), skinning the animal (~~scraped~~ scraper), allowing access to meat and hides for clothes or shelters, cutting meat into manageable sizes for cooking and eating, digging in the ground for planting or burying (Neanderthals were the first species of ~~homo~~ hominin to bury the dead) and constructing shelters. Being able to find and process food using tools allowed neanderthals a more nutritious diet, ~~increased~~ resulting in increased health, ~~brain~~ size energy, brain size and survival rates. Construction of shelters allowed Neanderthals better protection from predators and the environment, increasing their health. The understanding and use of rope making likely stemmed from development in both Vernickles and Brocas area of the brain, which are responsible for speech and interpretation of speech. This allowed communication and shared ideas between individuals allowing for the development of this technique. They also had increased capacity for abstract thought and imagination, which <sup>due to</sup> development in the brain, ~~increased~~ <sup>05961</sup>



aided in developing this technique.\*

Using twisted fibre for food gathering aided neanderthal survival in the cold European climate. Neanderthals were likely able to fashion vessels or ways of carrying resources back to their shelter to be stored (e.g. basket like vessels). Gathering and storing food using twisted fibre allowed for a large stockpile of food to be made more efficiently for the cold winter months where food resources were scarce. This would allow neanderthals to survive as they would not starve in the cold conditions.

\*Development in areas that support abstract thinking also aided in developing this technique.



### QUESTION THREE: The island of Flores

Remains of one of the most recently discovered early human species, *Homo floresiensis*, have been found only on the island of Flores, Indonesia. The fossils of *H. floresiensis* date to between 60 000–100 000 years old, and stone tools made by this species date to between about 50 000–190 000 years old. *H. floresiensis* individuals stood approximately 110 cm tall, had small brains, large teeth for their small size, and relatively large feet for their short legs. Despite their small body and brain size, *H. floresiensis* made and used stone tools, hunted small elephants and large rodents, and coped with predators, such as the giant Komodo dragon. Recent evidence suggests that *H. floresiensis* did not use fire; previous evidence for the use of fire is now associated with the later *Homo sapiens*.



Flores, an island located in the Indonesian archipelago.



Artist's impression of *H. floresiensis* attacking a Komodo dragon.



Male Komodo dragons weigh 85 kilograms, on average.

Discuss reasons for the success of *H. floresiensis*. In your answer, include discussion of:

- how their small size might have enabled population success on the island
- the success of *H. floresiensis* despite not having controlled use of fire
- TWO reasons why substantial brain development would be a selective advantage to early hominin species.



The small size of *H. Floresensis* aided its success on the island. This is because its small size required less energy to fuel, therefore less resources were needed to sustain it. It was potentially easier for it to take shelter and hide from predators, ~~and easier for it to travel with~~. \* next page

*H. Floresensis* succeeded despite not having controlled fire. This was likely because ~~they had~~ of the warm climate, making fire unnecessary for warmth. *H. Floresensis* had large teeth allowing for an unprocessed diet of raw meat from hunted animals, and fruit and nuts of the area. They potentially used tools for opening fruit and nuts, and processing meat to be a manageable size, making the use of fire to process food not a necessity. The environment was likely plentiful with fruit etc. to sustain *H. Floresensis*.

Substantial brain development allowed for abstract thought and cooperation between individuals. The use of abstract thought to develop tools offered a survival advantage, as *H. Floresensis* were able to hunt and defend themselves, gaining a reliable source of food and protection. This offered a selective advantage to individuals with ~~the~~



substantial brain development. Brain development also allowed for cooperation and sharing of ideas. *H. Floransis* potentially shared tool making ~~techniques~~ techniques and hunted cooperatively, helping overcome their size disadvantage when it came to large animals/predators. This would offer an ~~advantage~~ selection advantage as early hominid species with ~~larger~~ brains that cooperated were more likely to survive. Abstract thought allowed *H. Floransis* a selection advantage as it was able to ~~think~~ think of creative ways to ~~overcome~~ overcome predators, again offering a selection advantage due to their more developed brain.

⊛ Their smaller size may also have allowed them to take advantage of small caves and other places to shelter.

⊛ more developed



## Excellence

**Subject:** Biology

**Standard:** 91606

**Total score:** 19

Q	Grade score	Marker commentary
One	M6	The response effectively explains the benefits of both the valgus angle and the S-shaped spine, linking each to balance, center of mass, and energy savings with the reduction in sway. Additionally, the advantages of bipedalism are well articulated.
Two	M6	Although this response does not fully address all aspects of the question, particularly the link between tool use and access to more nutritious food, it does establish a strong connection between adaptation to cold environments, food gathering, and how the new skills would have supported health.
Three	E7	The response shows a solid understanding of survival despite the absence of fire on the island, demonstrating detailed knowledge of Flores and its food resources. It makes effective links from small stature to resource scarcity and explains the advantages for early hominins, including brain development.