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3

90719

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 3 Biology, 2006

90719 Describe trends in human evolution

Credits: Three
9.30 am Thursday 30 November 2006

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 answer ALL the questions in this booklet.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–10 in the correct order and that none of these pages is blank.

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

For Assessor's use only	**Achievement Criteria**				
Achievement		**Achievement with Merit**		**Achievement with Excellence**	
Describe trends in human evolution.		Explain trends in human evolution.		Discuss trends in human evolution.	
Overall Level of Performance					

You are advised to spend 40 minutes answering the questions in this booklet.

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QUESTION ONE: TRENDS IN BIOLOGICAL EVOLUTION

Evidence from a range of fossil skeletons shows that our ancestors were walking on two legs more than 4 million years ago.

Figure 1: Four views of a reconstructed *Sahelanthropus* skull.
Zollikofer et al., 'Virtual reconstruction of *Sahelanthropus tchadensis*', *Nature* (2005), 434: 755–759

Sahelanthropus tchadensis is known only from a single skull, discovered in Chad in 2001. Scientists have used computers to create a virtual reconstruction of the skull, and from this are able to draw some conclusions about the individual's method of locomotion.

(a) Describe TWO features of the skull that indicate *Sahelanthropus* is a primate.

(b) Explain how evidence shown in the reconstruction above indicates whether or not this individual walked bipedally.

(c) Describe TWO features of a **fossil skeleton** – NOT the skull – that would indicate that the individual walked on two legs.

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(d) Bipedalism would have provided advantages to hominins, whether they lived in forests or on the savannah.

Compare and contrast these advantages.

QUESTION TWO: TOOL-MAKING TRENDS

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While chimpanzees (and, by extension, early hominins) are skilled at making simple tools, the more complex stone tool technology associated with the genus *Homo* requires a much greater degree of precision and manipulative ability.

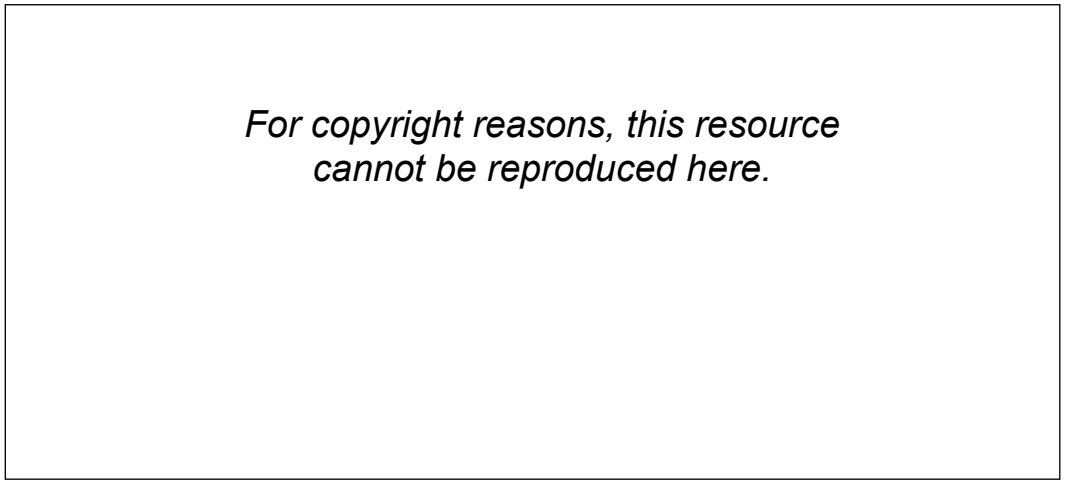

Figure 2: Precision grip in (a) human and (b) chimpanzee.

R. Susman, 'Hand function and tool behaviour in early hominids', *Journal of Human Evolution* (1998), 49: 23–46

(a) Describe the feature of the **human hand** that allows for its greater degree of precision and dexterity.

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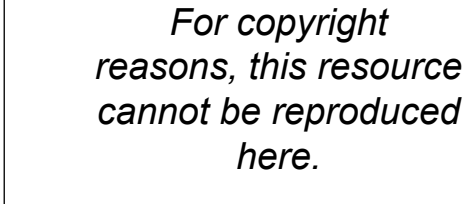
Scientists compared the amount of cutting edge that could be obtained from a given mass of rock, and the amount of work needed to produce a typical stone tool using two different stone-age technologies.

Table comparing tool manufacture using Acheulean and Mousterian technologies

(Lambert, *Cambridge Guide to Prehistoric Man*, pp 144, 145)

	Acheulean tools (associated with *Homo erectus*)	Mousterian tools (associated with *Homo neanderthalensis*)
Length of cutting edge produced from 500 g of stone	0.2 metre	1 metre
Number of blows needed to make a typical tool	65	111
Example of each technology	Acheulean hand-axe  http://www.personal.psu.edu/users/w/x/wxk116/axe/axe17a.gif	Mousterian axe  http://anthro.palomar.edu/homo2/mod_homo_3.htm

(b) Use information from the table to describe ONE trend in tool manufacture.

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More complex Aurignacian technology was used by Cro-Magnon people (*Homo sapiens*) to make flint flake knives and a range of other tools. It could take more than 250 separate blows to make one knife, and this included careful finishing. 500 g of stone produced up to 12 m of cutting edge.

Figure 3: An Aurignacian flint blade.

http://www.um.u-tokyo.ac.jp/publish_db/Bulletin/no06/no06002.html

(c) Making complex tools would require a great deal of time.

Discuss **how and why** Cro-Magnon society could support the toolmakers.

QUESTION THREE: DISPERSAL

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Figure 4 shows a route that *Homo sapiens* could have followed in migrating out of Africa about 65 000 years ago. Many scientists now agree that this migration occurred relatively rapidly, and that Europe was settled considerably later than Asia and Austronesia.

Figure 4: The Old World during the late Pleistocene, around 65 000 years ago, showing a possible route for coastal migration of modern humans from Africa to Asia.

C. Stringer (2000), 'Coasting out of Africa', *Nature* (2005), 405: pp 24–26

During the Pleistocene, the world was affected by a series of glaciations (the Pleistocene 'Ice Age'). This would have had a marked effect on climate and environmental conditions. Huge amounts of water were trapped in continental ice caps, changing sea levels around the world.

(a) Explain how humans were able to migrate so rapidly into areas such as south-east Asia.

(b) Modern humans reached Australia as long as 60 000 years ago. This was at much the same time as they were moving into Europe, despite the fact that Europe is much closer to Africa. Explain why modern humans were relatively slow to colonise Europe.

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Scientists studying early human migrations obtained mtDNA (from blood samples) from a large number of populations living in coastal regions in Africa and Asia. Analysis of the mtDNA sequences gave the phylogeny shown below.

Figure 5: Phylogeny of coastal populations, based on mtDNA data.
Time on y-axis, populations on x-axis.

MacAulay et al., 'Single, rapid coastal settlement of Asia revealed by analysis of complete mitochondrial genomes', *Science* (2005), 308: 1034–1036

(c) Explain how the data in Figure 5 support the idea of a rapid migration from Africa along the **coastal route** shown in the map (Figure 4) on page 7.

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Mutations arising within a population can be tracked through the generations to give information on lineage as well as time from the original ('founder') mutation. The PTC Taster gene, which occurs in humans throughout the world, is one that can provide information on human dispersal. The mutant allele, which codes for the inability to taste PTC, arose 100 000 years ago. Seven different forms of the gene exist in Africa, but only the major taster and major non-taster forms have been found in populations outside of Africa.

(d) Discuss how this information relates to hypotheses explaining the origin and dispersal of **modern** *Homo sapiens*.

Extra paper for continuation of answers if required.
Clearly number the question.

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Question number