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NZQA

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MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
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Level 3 Biology, 2016

91606 Demonstrate understanding of trends in human evolution

2.00 p.m. Thursday 10 November 2016
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 and clearly number the question.

Check that this booklet has pages 2–15 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.

Merit

TOTAL 17

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QUESTION ONE

Documenting similarities and differences between Hominid species is fundamental to understanding their biological and evolutionary relationships. The skulls A and B show some similarities and differences. Anthropologists have agreed that Skull A is older than Skull B.

Skull A

https://blogopithecus.files.wordpress.com/2009/03/tcahd-3d-reconstruction.jpg

Skull B

www.sideshowtoy.com/mas_assets/jpg/KAM05_press01-001.jpg

www.anthrophoto.com/cgi-bin/ImageFolio31//imageFolio.cgi?search=under&img=&cat=&bool=phrase

www.sideshowtoy.com/mas_assets/jpg/KAM05_press02-001.jpg

http://www.dlt.ncssm.edu/tiger/360views/Hominid_Skull-Homo_erectus_PekingMan_1200x900/top-bottom/Hominid_Skull-Homo_erectus_PekingMan-top-900.jp

Discuss the selective forces which would support the evolutionary changes observed in Skull B compared to Skull A.

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In your discussion:

- describe FOUR features that support Skull A being older than Skull B
- explain how these identified features can be linked to evidence of bipedalism, and to the types of food these hominids ate
- discuss how the changes in the skull features have led to evolutionary trends in bipedalism, diet, and intelligence of hominids.

1. The foramen magnum is located further back on the back of the head in skull A than skull B. The foramen magnum on skull B is much closer to the ~~centre~~ center.

2. Skull A has large incisors at the front of the mouth whereas skull B has much smaller teeth.

3. Skull A has wider zygomatic arches (cheekbones) than skull B.

4. The skull of skull A is much more long and flat. Skull B is more rounded and more similar to a modern humans. The foramen magnum in modern humans is located in the center of the skull. This indicates as S shaped spine which indicates to evidence of bipedalism. An S shaped spine allows the head to sit above the center of gravity rather than in front of it. The small teeth of skull B indicate that it was omnivorous (eating meat and plants). The incisors

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and molars of skull A indicate it ate a lot of meat. Incisors are used for the cutting up of tough meat and the large molars are for grinding and shearing tough foods which could have been plants or meat.

Changes in skull features such as the increased rounding of the skull have led to an increase in the size of the brain. The brain casing in the skull was larger so the size of the brain increased. Changes in the teeth made it possible for hominids to eat a more varied diet. which also could lead to an increase in brain size. For example, eating fish provides omega 3 which is good for the brain. and could lead to an increase in the intelligence of hominids.

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M5

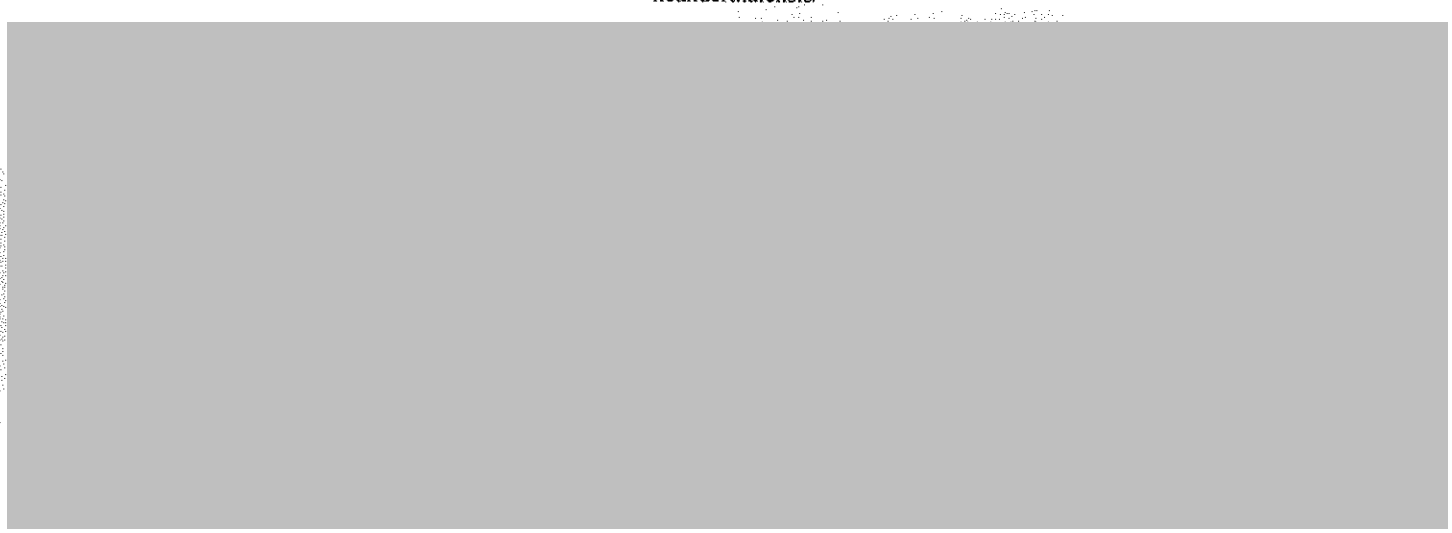
QUESTION TWO

Homo habilis, *Homo erectus*, and *Homo neanderthalensis* have developed different forms of cultural evolution to help them survive successfully in their ecological niche. Some of these forms of cultural evolution are shown in the pictures below.

Homo habilis
http://earlyman.yolasite.com/homo-habilis.php

Homo neanderthalensis
http://ies.aquiscelenis.climantica.org/2012/02/20/homo-neanderthalensis/

http://hoopermuseum.earthsci.carleton.ca/neanderthal/neanderthal.jpg



Homo erectus
www.erasmatazz.com/library/science/the-phylogeny-of-play.html

www.flashofgold.com/14-events-that-changed-military-history/

Analyse the different aspects of cultural evolution.

In your analysis:

- define cultural evolution
- describe the different forms of cultural evolution associated with *Homo habilis*, *Homo erectus*, and *Homo neanderthalensis*
- explain how these different forms of cultural evolution are adaptive advantages for the species who use them
- discuss the advantages and disadvantages that cultural evolution has had on biological evolution.

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Cultural evolution is a non-genetic means of adaption. It is learned and can be passed on from generation to generation. Homo habilis is associated with being the first homo species to use tools. H. habilis used Oldowan tools which were simple river pebbles with flakes removed to ~~make~~ more a cutting edge. These tools allowed H. habilis to cut and chip branches. Homo erectus is associated with being the first homo species to use fire. Fire offered protection from predators, warmth, it established a home base, could be used to harden wooden spear points and was used to cook food. Cooking food killed parasites and bacteria, making food safer to eat, it meant ~~their~~ their diet became more varied as they could cook food which was unpalatable raw, it meant that less time was spent eating and less energy was used to gather food. Fire allowed more time for social developements as less time was spent gathering food. H. ~~Erectus~~ Erectus is also associated with Acheulian tool culture. Acheulian tools had more flakes removed than Oldowan tools and were generally tear shaped H. erectus ~~made~~ made hand axes which were used to

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~~Homo Neanderthalensis~~

kill and skin prey. ~~They also could~~
Homo Neanderthalensis are associated with
Mousterian tools. These were more advanced
and they used things such as spears.
~~The~~ Spears offered a way to kill prey
from a further distance which increased
survival of hunters. H. Neanderthalensis
also made clothing from skins as shown
by DNA evidence. ~~Not~~ Their teeth were
worn down from gripping hide with their teeth
~~with their mouths~~. They made jewellery
from bones and wood and there is
evidence that they cared for the sick
or injured even though the injured
were unable to hunt. AND H.
Neanderthalensis buried their dead. The
dead were accompanied by jewellery and
tools which show that H. Neanderthalensis
may have thought of an afterlife.
An advantage of cultural evolution was
how it caused an increase in brain
size and development. This is due to
the discovery of making tools and fire
as these led to social development.
A disadvantage of cultural evolution
on biological evolution is that other
areas of the brain or body may not
have become well developed.

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QUESTION THREE

Modern humans began to migrate out of Africa around 100 000 years ago. Map 1 below shows the migration paths that modern humans took.

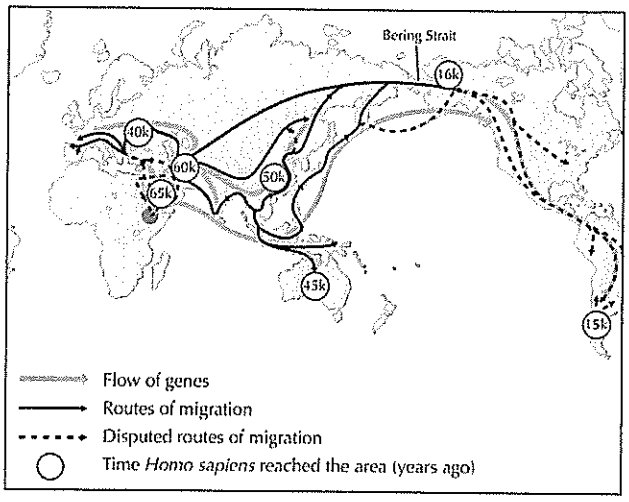
As humans moved through Europe and Asia they would have met these earlier hominins, like the Neanderthals in Europe and Denisovans in Asia (Map 2).

Scientists analysed the genetic information of more than 1 500 people from all around the world, and determined that ancestors of modern humans interbred (admixture) with Neanderthals and Denisovans.

Today, the genetic makeup of most people born outside Sub-Saharan Africa is 1 to 4 percent Neanderthal. The Denisovans also left Africa early, and like their Neanderthal relatives, they interbred with *Homo sapiens*.

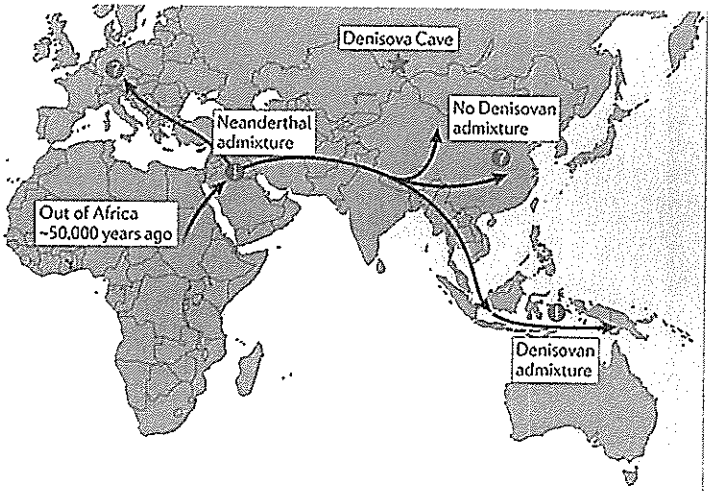
The Tibetan people have a variant of the EPAS1 gene that allows them to deal with low oxygen with fewer red blood cells than the rest of us. Their blood stays thin and healthy 4.8 kilometres up. This gene can be traced back to the Denisovans; they shared this gene with people who now live in Tibet.

HLA is a gene that helps white blood cells destroy micro-organism intruders in our bodies. Researchers believe people carrying this gene can thank Neanderthals and Denisovans for it, as these hominins had already adapted to infections and diseases found outside Africa.



Map 1. Migration Routes of *Homo sapiens*

Adapted from: Sinclair, Anna Roberts & M. *Level 3 Biology Study Guide*, 3rd Edition. ESA Study Guide



Map 2. Migration Route and Regions of Admixture

http://www.nature.com/nrg/journal/v12/n9/fig_tab/nrg3029_F4.html#figure-title-history/

Discuss the advantages and disadvantages of taking the various migration routes, and the possible effects that this has had on cultural and biological evolution.

In your discussion:

- describe the reasons for dispersal to other regions, and identify the benefits gained from the dispersal
- explain how changes in the environment could have influenced the migration routes used
- explain how the evidence of mtDNA and DNA analysis support the 'out of Africa' dispersal model
- discuss how admixture (interbreeding of two previously isolated populations) could have helped with dispersal.

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Reasons for dispersal to other regions may have due to a push from the possibly dwindling resources or a desire to explore new areas. Dispersal could have been caused by a desire to find more favourable conditions such as better food sources or a better environment. The benefits of dispersal may have been ~~the~~ colonisation of a new area and a more varied diet or better food supply. During this time period, more land bridges were appearing and these would have influenced the migration routes used by humans. The land bridges would have meant there were limited places for the modern humans and early hominins to cross during their dispersal. Change in the environment such as the temperature would have influenced the ~~humans~~ hominins to stay in favourable conditions eg. they would travel in a direction of ~~the~~ favourable climate. The out of Africa model states that H. erectus left Africa for Europe and Asia and established regional populations. The only H. erectus living in Africa developed into, first, H. heidelbergensis then

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H. sapiens. These H. sapiens then dispersed out of Africa to Europe and Asia following the same migratory routes as H. erectus. H sapiens then replaced these regional populations due to their superior adaptive advantages. Mt DNA is inherited maternally. Mt DNA and DNA analysis support the Out of Africa model as they have revealed that African people have more genetic diversity than anywhere else in the world. This is a result of founder effect which is a reduction in the genetic diversity of a group when a group leaves a population. Mt DNA has also shown that a common ancestor can be traced all the way back to one female in Africa.

Interbreeding between two previously isolated populations would lead to a increase in genetic diversity within that population. This admixture could lead to people better suited to a range of environments which could have arisen with dispersal

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Extra paper if required.
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* This supports the out of Africa dispersal model.

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Annotated Exemplar Biology Level 3, 91606

Merit exemplar 2016

Subject:	Biology	Standard:	91606	Total score:	17

Q	Grade score	Annotation
1	M5	The candidate provided a clear explanation for the position of the foramen magnum and described other features to suggest skull B is younger than skull A. To attain M6 the reduction in size of the zygomatic arch, (saggital crest and associated jaw muscles) should be linked to the type of food likely to be eaten by Skull B.
2	M6	The candidate correctly explained the adaptive advantage for each of the tool cultures associated with the 3 hominins. To gain Excellence the candidate needed to clearly identify and discuss one advantage that this form of cultural evolution had on biological evolution.
3	M6	The candidate correctly explained how changes in the environment affected the dispersal routes followed by early H. sapiens. In addition the candidate accurately explained how the use of mtDNA supports the Out Of Africa theory of the dispersal of H. sapiens. In order to attain Excellence the candidate needed to discuss the advantages and disadvantages associated with taking the various dispersal routes or how the admixture would have likely helped the dispersal of H. sapiens into new areas.