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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
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Level 3 Biology, 2017

91606 Demonstrate understanding of trends in human evolution

9.30 a.m. Thursday 16 November 2017
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 2–12 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 16

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QUESTION ONE

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Biological evolution of the hand has been important in hominin evolution. Below are the hands of *Ardipithecus ramidus* and *Homo neanderthalensis*. Changes in the evolution of the hand are strongly linked to changes in the environment.

Ardipithecus ramidus | *Homo neanderthalensis*

http://scienceblogs.com/laelaps/2009/10/02/will-the-earliest-known-homini/
http://science.sciencemag.org/content/326/5949/70.full

https://iphcsnews.wordpress.com/2015/06/30/why-did-neanderthals-use-the-teeth-as-a-third-hand/
http://pubpages.unh.edu/~jel/images/Neanderthal_grip.jpg
http://kids.britannica.com/students/assembly/view/202300

Analyse the evolutionary trends displayed in the hands shown above, AND discuss how changes in the environment and bipedalism would lead to these evolutionary changes.

In your answer:

- describe two evolutionary trends in the structure of the hands shown above
- explain how changes in the environment are likely to have led to the changes you have identified
- discuss the adaptive advantages that changes in the hand and bipedalism could have provided.

In the skeletal ~~fractures~~ structures of the hands shown above we see two main differences. The first is that the fingers of Ardipithecus ramidus (A. ramidus) are far more bent at rest than Homo neanderthalensis (H. neanderthalensis). This is due to the ~~Are~~ A. ramidus being one of the first bipedal hominids ~~A. ramidus had a very common~~ it had only been a short time since hominids were living

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in trees and used brachiation as a form of locamotive. However when sudden changes to the environment came (forrests changed to savannah) when the amount of trees became much fewer, hominids had to become bipedal which became a much more practical way of locomotive. The bent fingers show evidence of a primal nature in which we see that A. ramidus is more closely related to brachiating hominids as their hands are still evolved for this form of locomotive. Whereas in H. neanderthalensis we see that while their fingers can bend, they aren't fixed in this bent position and so the fingers became well suited to brachiation and more suited to picking up objects. we see this because on H. neanderthalensis we see they have an aposable thumb which makes it easier with a power and precision grip. for them to pick up items with their hands. When hominis became bipedal, they were able to have their hands free for uses rather than always having to hold onto a branch. So they started finding other uses for their hands meaning they could pick things up and eventually make tools. Over time when using their hands for things became more and more common because they had them free, they would need less of the hand features that helped them to brachiate and more of devises that allowed them to have a precision grip and allow them to make their own tools. H. neanderthalensis is more closely related to us than any primal hominid species and so the aposable thumb is much like we have today in which has a very precise grip. This would mean

There is more space for your answer to this question on the following page.

that H. neanderthalensis was able to make more sofisticated tools with ~~higher~~ more complexity making their lives easier. Because of the A. ramidus' hand shape due to ~~closely~~ it being closely related to a primal hominid species, they did not poisess apposable thumbs and therefore couldn't pick up items as precisely and firmly ~~as~~ as later hominid species ~~and therefore~~ so tools were not accessible to A. ramidus or many of the early hominin species. Other adaptive advantages of being bipedal include, being able to stand up giving them a better look for predators in long grassy environments, and being able to forage more easily for vegetation ~~of~~ on the ground.

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The examination continues on the following page.

QUESTION TWO

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Oldowan chopper
www.aggsbach.de/wp-content/uploads/2014/07/fighcehd.jpg

Acheulean hand axe
https://nz.pinterest.com/pin/79376012161481249/

Neolithic axe
https://chw3m1.wikispaces.com/Neolithic+Types+of+Tools+or+Weapons-+Materials+and+Use?responseToken=e872917f8c94dca9e00d062639f33374

Fire
http://wonderopolis.org/wonder/how-was-fire-discovered

Birthing canal of selected hominins
https://aspergerhuman.files.wordpress.com/2014/10/800px-homo_erectus_pelvis21.jpg

Average size of cranial capacity in selected hominins
http://fhs-bio-wiki.pbworks.com/w/page/24003004/Hominid%20evolution

The advancement in [cultural] evolution such as the development of clothing, tools, language, and the use of fire has had an effect on biological evolution.

Explain how cultural evolution can affect biological evolution, AND justify the effect this had on the evolutionary trends of the skull and pelvis.

In your answer:

- describe the difference between cultural and biological evolution
- describe the trends in cultural evolution and biological evolution of the skull and pelvis, and explain the selective pressures that could lead to these cultural changes
- justify how cultural evolution has affected biological evolution of the skull and pelvis.

cultural evolution is how a species has evolved through non biological features such as art, tools language and

food could be eaten. This again contributed to the brain growth over time as it meant the increase in food, could be converted to an increase in energy which could feed a larger brain. Larger cranial capacities and brains however meant that the cranium of later homins like ~~hom~~ H. sapiens had to be bigger and this meant right from in the womb. However in becoming bipedal, ~~H. sapie~~ later homin species have their pelvis in their center of gravity which needs to be a lot smaller in order to keep them balanced. Therefore the decrease in pelvis size and increase in cranium size contradict eachother when it comes to child birth. The circumference of the pelvis inlet is only slightly larger than the circumference of a new born's skull, leaving little room for the baby to be birthed. This meant if the baby was going to be born, ~~it would have~~ the mother would have to have a pelvis big enough or it's offspring therefore small pelvis genetics cannot be passed on. So the small pelvis meant in H. sapiens that a selection pressure in which too small of pelvis' were selected against as they could not produce offspring.

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M6

QUESTION THREE

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There is a lot of debate about how modern humans dispersed throughout the world. As more fossil evidence is discovered, and DNA is extracted and analysed, the ideas of human dispersal have changed in recent years. The two main widely accepted theories are the multiregional theory and the replacement theory (out of Africa theory).

Multiple sources of evidence are used to support each theory, such as DNA analysis, mtDNA analysis, and fossil structure.

Replacement theory (out of Africa theory)

Multiregional theory

Adapted from: http://anthro.palomar.edu/homo2/images/models_of_Hss_evolution.gif

Compare and contrast the replacement theory (out of Africa theory) with the multiregional theory, explaining how different evidence supports each theory, and any challenges involved.

In your answer:

- describe the replacement (out of Africa) and multiregional theories
- explain how different sources of evidence are used to support each theory, and the challenges with using fossil evidence
- compare and contrast the replacement theory (out of Africa theory) with the multiregional theory.

The out of Africa theory shows that ~~w~~ ~~habilis~~ homoerectus moved out of Africa into Asia and Europe and no interbreeding took place. It shows that archaic humans went extinct in Asia and Europe and when ~~early~~ ~~human~~ modern humans evolved in Africa, they then dispersed again. The multiregional hypothesis shows that while H. erectus was still the first to leave Africa, that there were no extinctions and a lot of interbreeding took place in which lead to ~~the~~ modern

There is more space for your answer to this question on the following pages.

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humans eventually evolving in all 3 continents, not just Africa. The ways that they hypothesise these is due to fossil, mtDNA, and nuclear DNA evidence gathered from skeletal remains. mt DNA evidence is mitochondral DNA. Mitochondrial DNA comes from only the maternal side, it is not crossed over and is unchanged when passed down from generation to generation. Only changes that occur are due to mutation. By looking at mt DNA we are able to see how closely related species are to eachother due to similarities from their mother's and ancestors before that's DNA. Nuclear DNA however shows the whole genetic make up of a hominin. ~~Bobbb~~ It contains all genetic information which it inherits half from the maternal side and the other half from the paternal side. This again shows the genetic make up so we are able to see how closely related species are due to their similarities ~~and~~ in DNA. The last thing scientists use in making up this time line is fossil evidence. Fossil evidence shows comparisons between skeletal remains of different hominins. This can be good when looking at ~~sk~~ similar features of skulls and spines however cannot always be accurate in determining how closely related species are. While they may look similar, similar selection pressures in different environments may have had an impact in which convergent evolution takes place. So fossil evidence may not tell us how closely related species are but it can tell us time lines. mt DNA and nuclear DNA evidence can help us to ~~us~~ see if interbreeding took place which would support the multiregional theory

as we can find evidence of other hominin species. ~~However~~ It would also show the extinction of a species as we could date skeletons using fossil evidence data and from this date specific parts of DNA working out if they are in any way related. if they aren't the species would have gone extinct.

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Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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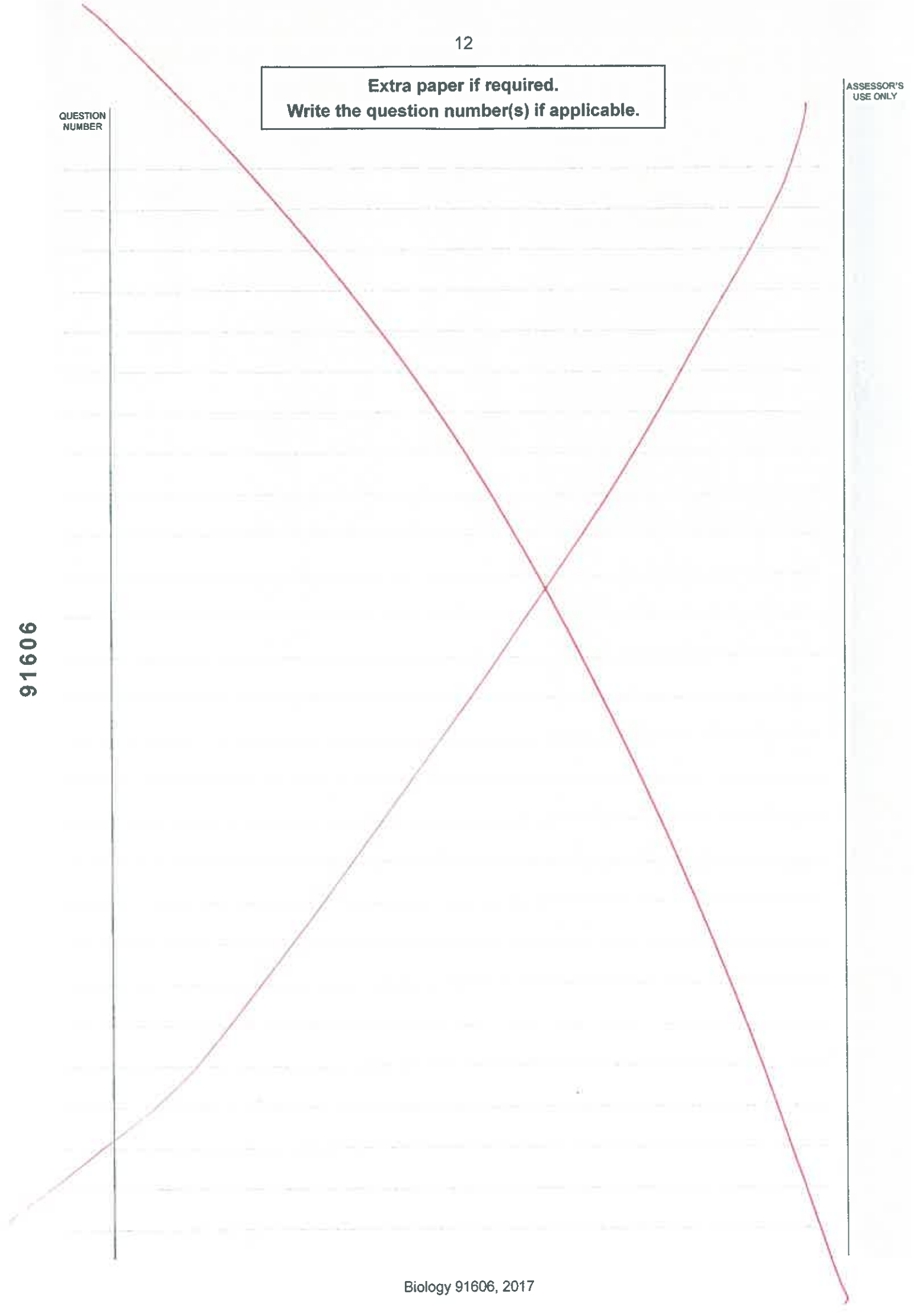

91606

Subject:	Biology	Standard:	91606	Total score:	16

Q	Grade score	Annotation
1	M5	The candidate was able to clearly explain how the changes in the environment from forest to grassland savannah provided the selective pressures which led to the structural changes in the hands of the early hominins. In order gain M6 the student needed be more accurate their explanation (using biological terminology) of how bipedalism was “favoured/selected for” during these times of environmental changes.
2	M6	The candidate was able to explain and link two specific cultural changes in named early hominins which affected changes to the biological structures of both the skull and pelvis regions of these species. In order to gain Excellence the student must discuss how this is an example of positive feedback loop for example how the tool culture has developed and has led to greater access to fats and proteins in the diet. This then leads to greater development of the brain as this provides a selective advantage towards an increase in the cranium.
3	M5	The student was able to explain evidence from both fossil & DNA to support both the replacement and multi-regional dispersal theories. The student was also able to explain some of the challenges that can occur when interpreting fossil evidence. In order to gain excellence the student needed to compare both theories of dispersal by clearly identifying similarities AND differences in the evidence used to support the replacement and multi-regional theories.