

# 3

91606



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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](http://www.sideshowtoy.com/mas_assets/jpg/KAM05_press01-001.jpg)

[www.anthrophoto.com/cgi-bin/ImageFolio31//imageFolio.cgi?search=under&img=&cat=&bool=phrase](http://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.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](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 ~~center~~ <sup>center</sup>.

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

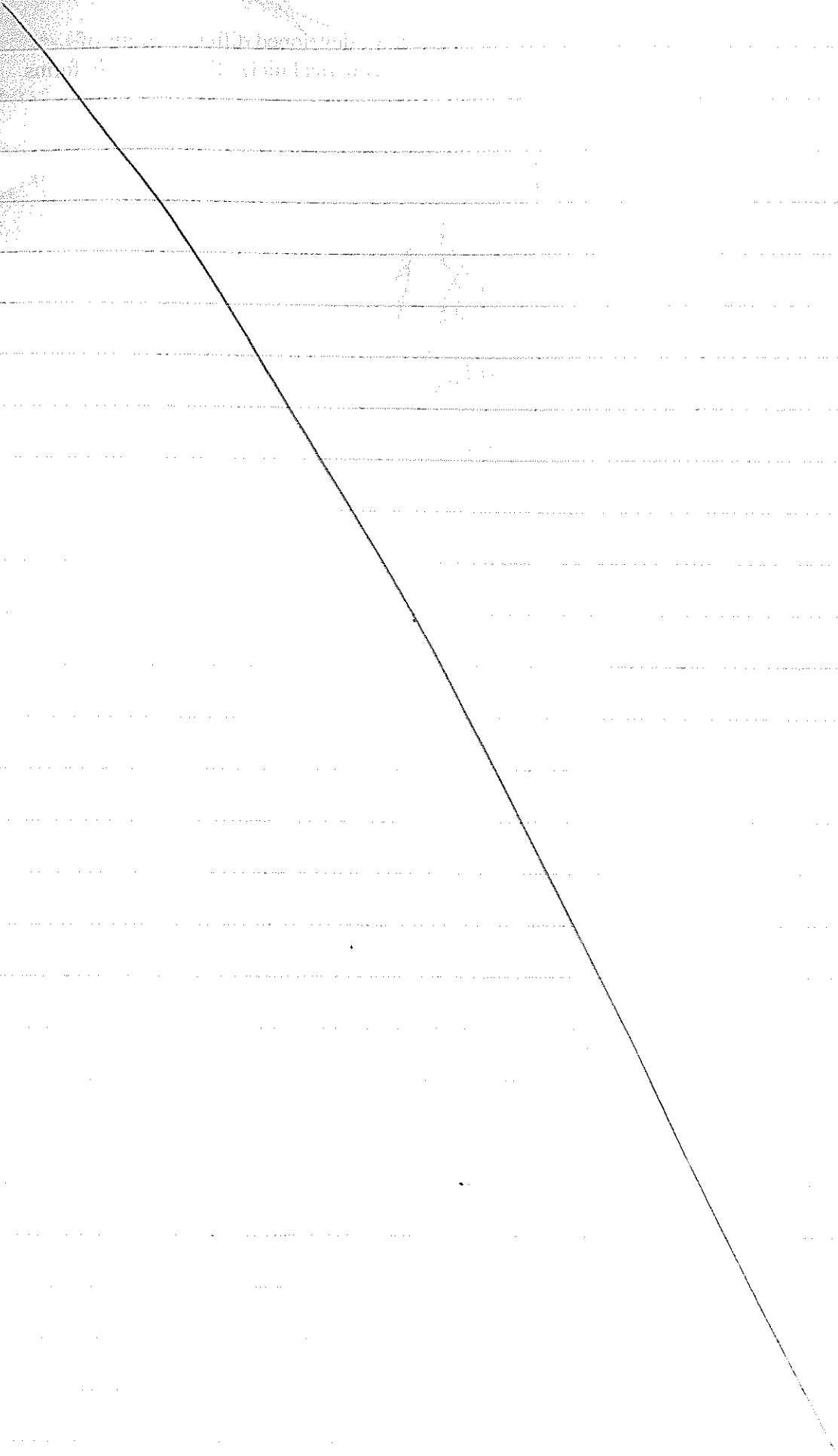
3. Skull A has wider zygomatic arches (cheekbones) than skull B.

4. The skull of skull A ~~is~~ <sup>is</sup> much more long and flat. Skull B is more rounded <sup>and more</sup> similar to a modern human. The foramen magnum in modern humans is located in the center of the skull. ~~This~~ <sup>This</sup> indicates ~~to~~ <sup>an</sup> S shaped spine ~~to~~ which indicates to evidence of bipedalism. An S shaped spine allows the head to sit above the center of gravity ~~rather~~ <sup>rather</sup> 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 ~~eating~~ <sup>the</sup> cutting up of tough meat and the large molars were for grinding and chewing tough foods which could have been plants or meat.

Changes in skull features such as <sup>the</sup> ~~the~~ rounding of the skull have ~~lead~~ <sup>led</sup> 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~~ 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.



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.

*Handwritten notes:*  
 associated  
 associated

### *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](http://www.erasmatazz.com/library/science/the-phylogeny-of-play.html)

[www.flashofgold.com/14-events-that-changed-military-history/](http://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.

Cultural evolution is a non-genetic means of adaptation. 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. ~~These tools~~ <sup>made</sup> a cutting edge. These tools allowed H. habilis to cut animal skin tracks. 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~~ <sup>their</sup> 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 time for social development as less time was spent gathering food. H. ~~erectus~~ <sup>Erectus</sup> is also associated with Acheulian tool culture. Acheulian tools had more flakes removed than Oldowan tools and were generally pear shaped. H. erectus made hand axes ~~which were used to~~ which were used to

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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.  
~~also~~ Spears offered a way to kill prey  
 from a farther distance which increased  
 survival of hunters. H. Neanderthalensis  
 also made clothing from hides as shown  
 by DNA evidence. ~~that~~ Their teeth <sup>were</sup> ~~were~~  
 worn down from gripping hide <sup>was</sup>  
 with their teeth ~~to their mouth~~. They made jewellery  
 from bones and wood and ~~there~~ <sup>there</sup>  
 evidence that they cared for the sick  
 or injured even though the injured  
 were unable to ~~hunt~~ <sup>hunt</sup>. AND ~~the~~ <sup>H.</sup>  
 Neanderthalensis buried their dead. The  
 dead were accompanied by jewellery and  
 tools which show that ~~the~~ <sup>H. Neanderthalensis</sup>  
 may have thought of ~~an~~ <sup>an</sup> after-life.  
 An advantage of cultural evolution was  
 that 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.

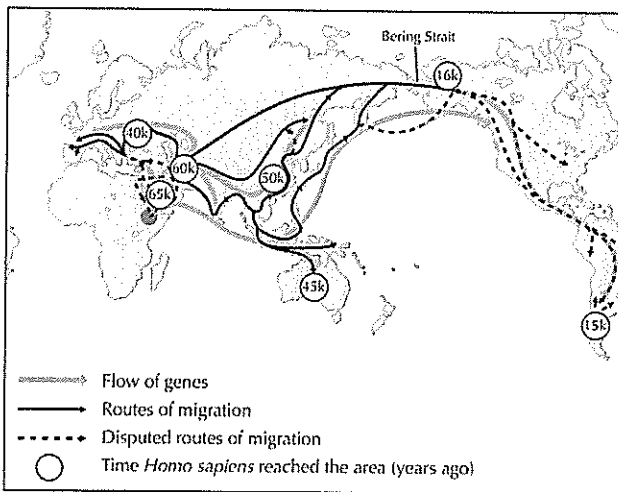
As humans moved through Europe and Asia they would have met these earlier hominins, like the Neanderthals in Europe and Denisovans in Asia (Map 2).

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*.

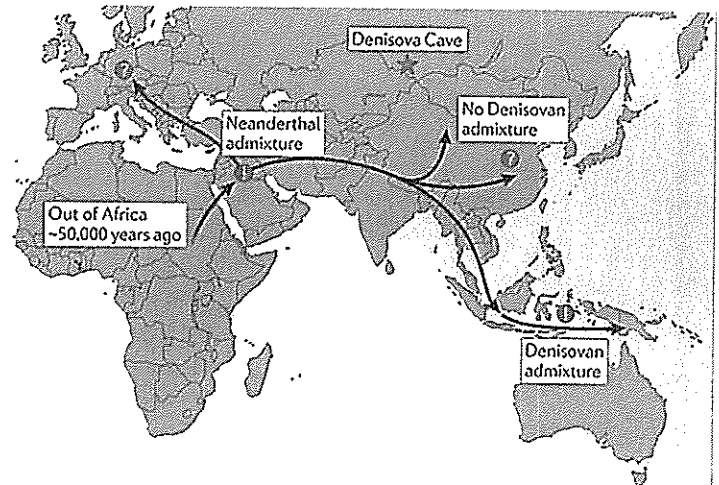
The Tibetan people have a variant of the EPAS1 gene that allows them to deal with low oxygen with fewer red blood cells than the rest of us. Their blood stays thin and healthy 4.8 kilometres up. This gene can be traced back to the Denisovans; they shared this gene with people who now live in Tibet.

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/](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.

Reasons for dispersal to other regions were due to a push from the possibly dwindling resources or a desire to explore new areas. Dispersal could <sup>have</sup> 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~~ 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 ~~hominins~~ <sup>hominins</sup> to stay in favourable conditions e.g. they would travel in a direction of ~~the~~ <sup>favourable</sup> climate. The out of Africa model states that *H. erectus* left Africa for Europe and Asia and established regional populations. Then 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 ~~was~~ <sup>analysis</sup> support the Out of Africa model as they have revealed ~~that~~ <sup>that</sup> African people have more genetic diversity than anywhere else in the world. This is a result of founder effect which is a reduction in <sup>the</sup> genetic diversity of a group when <sup>a group</sup> ~~they~~ 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 an increase in genetic diversity within that population. ~~These~~ <sup>This</sup> admixture ~~could~~ could lead to ~~the~~ <sup>people</sup> better suited to a range of environments which could have aided with dispersal.

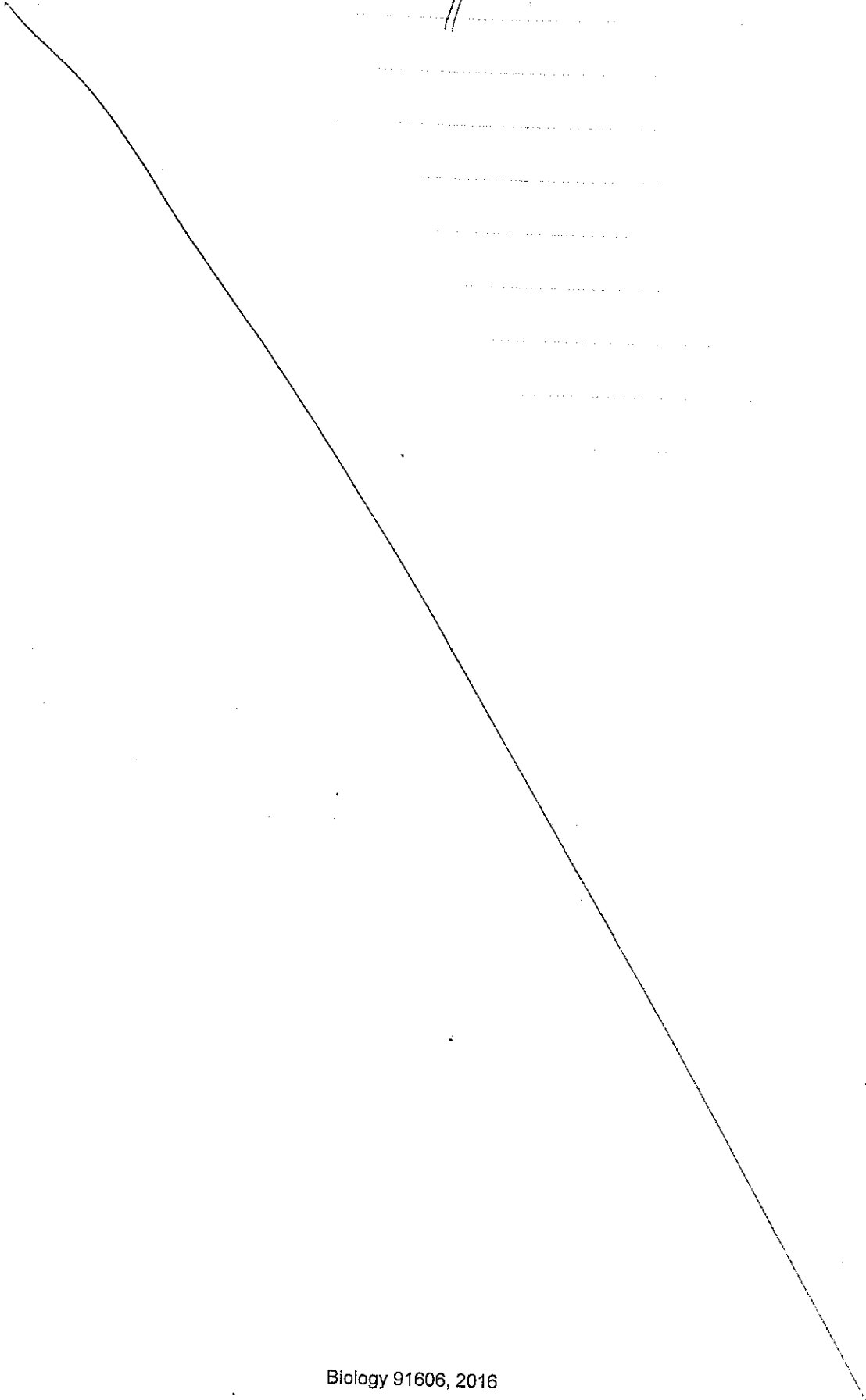
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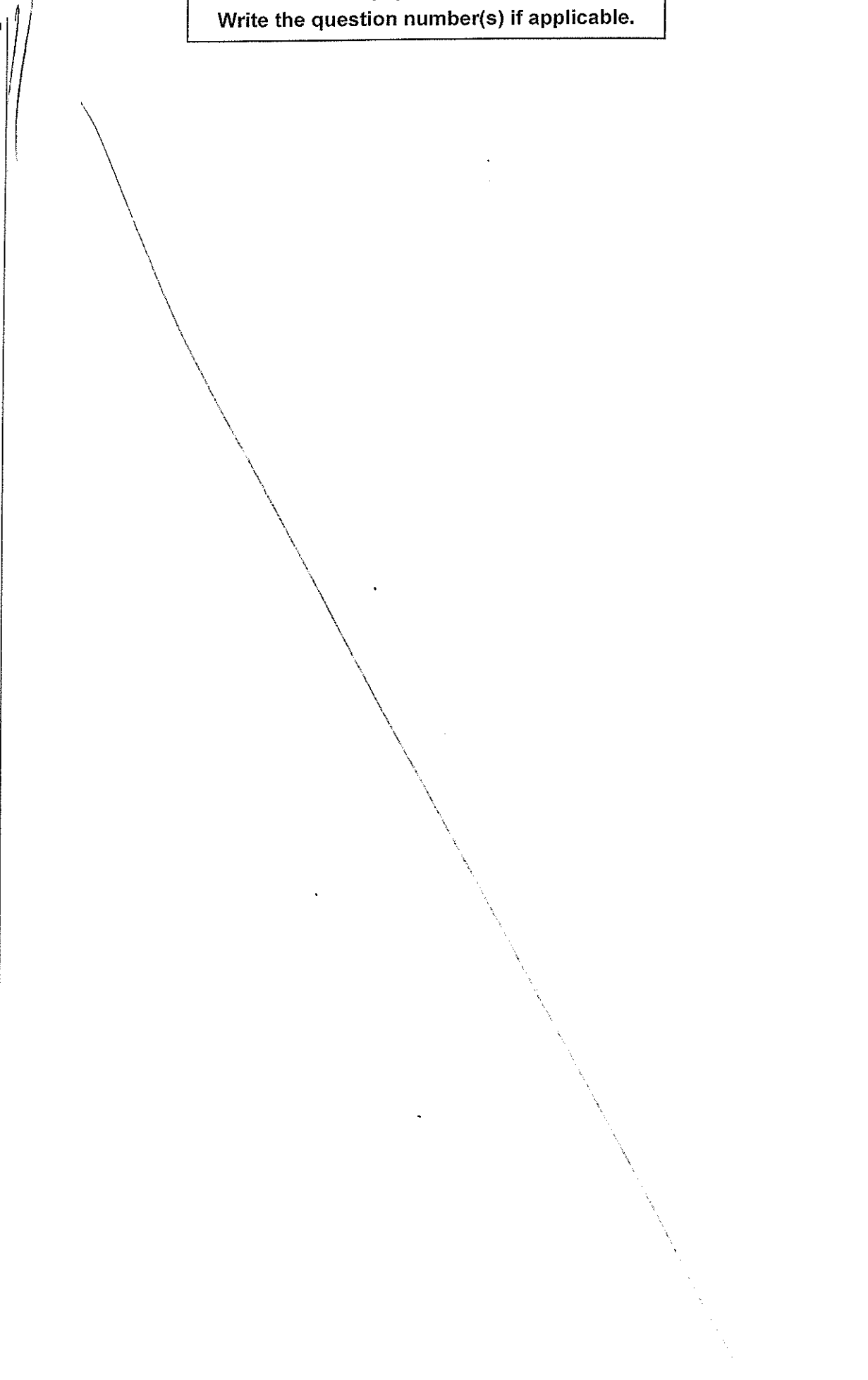
\* This supports the Out of Africa dispersal model.



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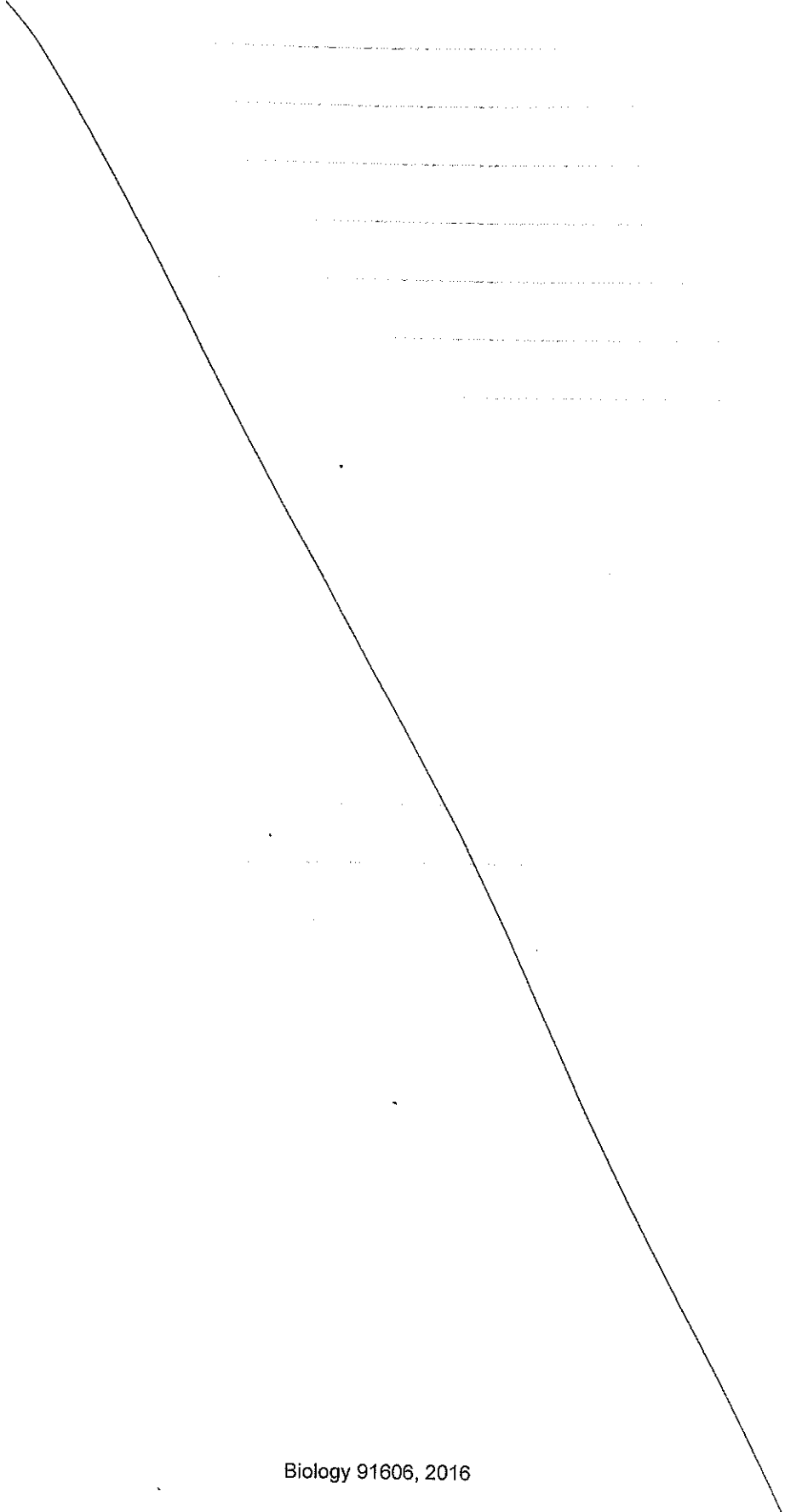
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## **Annotated Exemplar Biology Level 3, 91606**

### **Merit exemplar 2016**

<b>Subject:</b>	<b>Biology</b>	<b>Standard:</b>	<b>91606</b>	<b>Total score:</b>	<b>17</b>
<b>Q</b>	<b>Grade score</b>	<b>Annotation</b>			
1	M5	<p>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.</p> <p>To attain M6 the reduction in size of the zygomatic arch, (sagittal crest and associated jaw muscles) should be linked to the type of food likely to be eaten by Skull B.</p>			
2	M6	<p>The candidate correctly explained the adaptive advantage for each of the tool cultures associated with the 3 hominins.</p> <p>To gain Excellence the candidate needed to clearly identify and discuss one advantage that this form of cultural evolution had on biological evolution.</p>			
3	M6	<p>The candidate correctly explained how changes in the environment affected the dispersal routes followed by early H. sapiens.</p> <p>In addition the candidate accurately explained how the use of mtDNA supports the Out Of Africa theory of the dispersal of H. sapiens.</p> <p>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.</p>			