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Level 3 Biology, 2015

91606 Demonstrate understanding of trends in human evolution

2.00 p.m. Monday 23 November 2015
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.

Excellence

TOTAL 22

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QUESTION ONE

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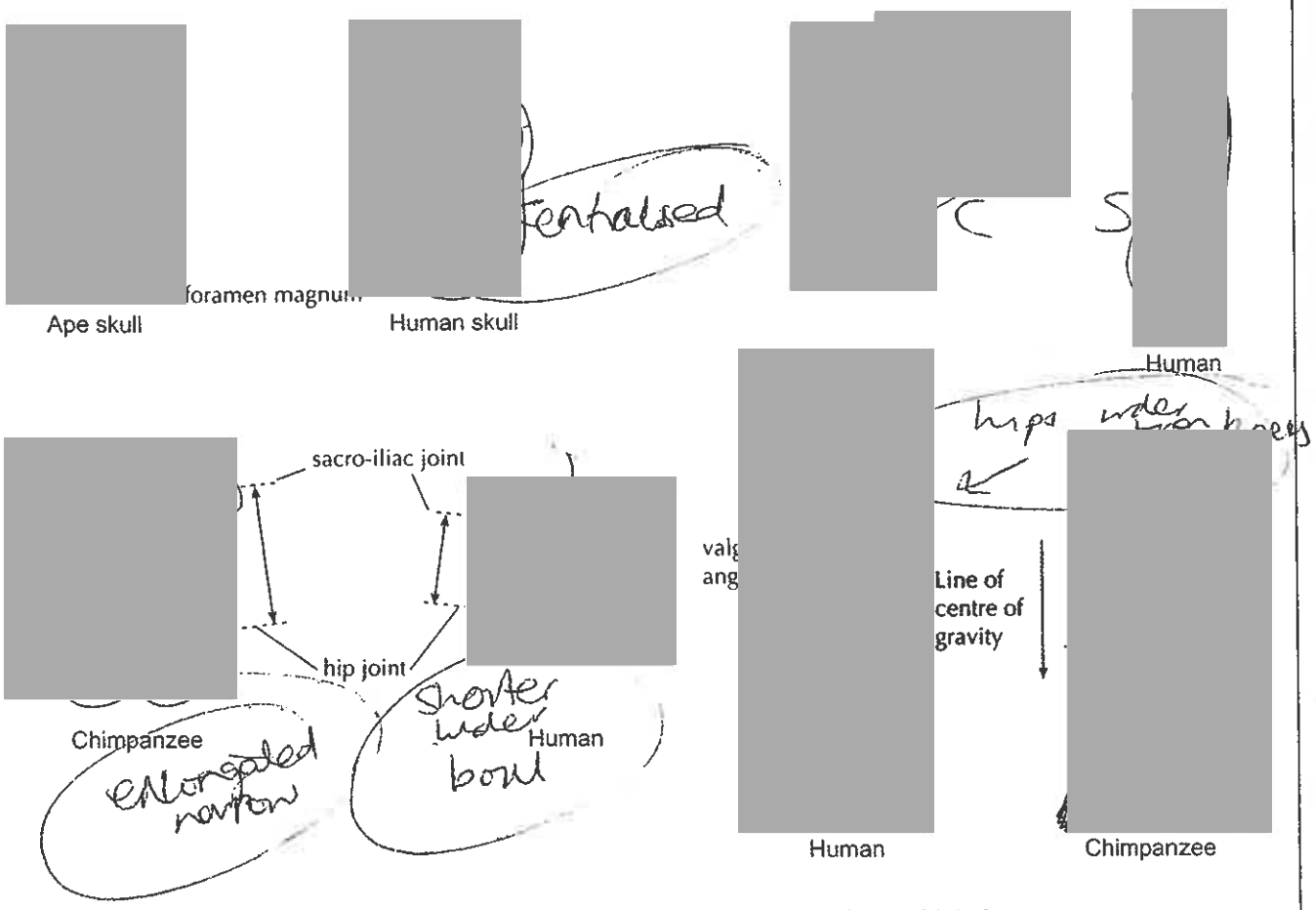
A distinguishing feature of hominins is habitual bipedalism. Comparisons of skeletal features of modern humans and extant (living) hominids such as the gorilla or chimpanzee, reveal several key features that are associated with the transition from quadrupedal species to bipedal species.

Some of the most important features are shown below.



Adapted from: Anna Roberts & Maria Sinclair, *ESA Study Guide: Level 3 Biology* (Auckland: ESA Publications (NZ) Ltd, 2013), pp 275–277

Discuss the importance of bipedalism in the development of hominins by linking the skeletal features to their adaptive significance.

In your answer:

- describe what is meant by the terms quadruped and biped
- explain how any three of the skeletal features (shown above) provide evidence for the form of locomotion changing to bipedalism
- justify why bipedalism was so significant to the evolution of hominins.

The term quadraped means that whereas locomotion is walk you uses your two frontal and two back limbs. whereas, bipedal means ~~walking~~ on two limbs. The spine curvature changing from a C quadraped shape to S curvature for bipedalism

acts as evidence. firstly, the spine of the ape was C-shaped because it allowed for the centre of gravity to be under the body, when walking in a ~~pr~~ quadrapedal motion. The S-shaped spine changes the centre of gravity to under the skull and acts as a shock absorber as more body mass is placed onto the lower limbs (not spread over all four limbs). - as it supports the upper body and pushes the buttocks outward. Secondly, the pelvis changing from an elongated, narrow shape to a wider, shorter bowl shape from chimpanzee to human acts as evidence for biped because not only does the wider pelvis support the upper body weight, thats, ~~no longer spread over~~ four limbs, but it allowed for the birth of a larger-brained baby - a follow on result of bipedalism - and ther takes more weight off the lower limbs.

Thirdly, the creation of a valgus angle as hips become wider than the knees (as in the quadrep chimp they were in line with the knees) allows for the centre of gravity to change position from infront of the body (~~quadrep~~ ape) to directly underneath the body (biped) reducing the side-to-side motion ~~than~~ when walking and the knee outer condyle enlarging also allowed for bipedalism to increase in efficiency. Also, the increase in the length of the legs is

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another point that indicates bipedalism, as longer leges meant longer strides could be taken and locomotion could become more efficient.

Bipedalism was so significant in early hominins as it became a positive feedback loop, allowing for significant cultural & biological evolution to flow-on from this change. Firstly, thermoregulation was made more efficient as less skin was exposed to the sun and greater surface area was exposed to the wind. Very beneficial in hot, African sun. Secondly, locomotion became significantly more efficient, allowing for adaptations like the spine, talgus angle & pelvis to allow future dispersal from Africa. Thirdly, hominins were made to look significantly larger and more menancing. But, the greatest change due to bipedalism would be the freeing of the hands, as they were no longer required for locomotion. As hominins become hairless, and babies were born in a less advanced state due to increasing brain size, the baby could no longer hold onto parents hair so needed to be carried. Also, the freeing of the hands led to interaction with the environment, the development of the highly sensitive digits and precision grip and ability for the rapid expansion of the cultural evolution to develop tools were able to be made and the

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QUESTION TWO

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Tool Culture Figure 1	Tool Culture Figure 2	Tool Culture Figure 3
		
http://zinken.typepad.com/palaeo/images	https://en.wikipedia.org/wiki/Stone_tool#/media	https://upload.wikimedia.org/wikipedia/commons/8/89
Upper paleolithic	Oldowan	Acheulean

The advance of the use of tools and fire had many effects on the evolution of hominins.

Discuss the likely impacts that the different tools and fire had on the different hominin species, and the evolutionary trends that can be linked to these developments.

In your answer:

- identify the three tool cultures as shown in the diagrams above, and link a species of hominin to each tool type
- explain the trends shown in the development of the tool cultures above, and how this shows a progression in the cultural evolution of the hominins
- discuss the likely effects that fire and the use and development of tools had on the biological evolution of the hominins.

The tool culture in figure one is the upper paleolithic tool culture, the most recent tool culture (40000 ya - present) and is linked to homo sapiens. figure 2 is an oldowan tool, ~~the most advanced~~ simple tool, 2.4mya - 160000ya. Linked to Homo habilis. The bifaced hand axe in figure 3 is linked to Homo Erectus, and is Acheulean tool culture.

figure 2, the oldest tool culture shows a small range and simplicity of tool through a small number of hits required to

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create the tool. The figure 3, second tool, Acheulean, shows many, planned strikes to create the bifaced hand-axe and the size of the tool also increases with its complexity. figure one shows the most recent tool culture, the upper Palaeolithic tool culture. A wide range of finely crafted and planned tools can be seen, using a combination of materials - not just over worn pebbles. This shows a progression linked to cultural evolution of the hominins as the number of specific tasks required to be completed by their stone tools can be seen. for example, culturally, they evolved from cutting flesh, chopping nuts & marrow out of bones to creating a fine point needle out of bone, able to sew holes together. As they biologically developed, able to plan ahead, and imagine a final product, these tools represent a subsequent biol-cultural evolution by representing the range of tasks completed by the Hominin species. The bone needle represents clothes and composite are of materials represents a respect for one's self/ spirituality.

fire, in respect to biological evolution, created a positive feedback loop because food was made softer, easier to chew & digest, and therefore the size of the gut decreased (biological consequence). The cooking of ~~to~~ fibrous plant

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QUESTION THREE

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http://madamepickwickartblog.com/wp-content/uploads/2012/01/cannibal4.jpg

http://io9.com/how-farming-almost-destroyed-human-civilization-1659734601

10-12000 YA

One of the most important milestones in human evolution was the transition from hunter-gatherer to agriculture or farming. Scientists have concluded that it is likely that the transition to farming was due to migration and replacement of existing populations, and not due to cultural transmission from farmers to hunter-gatherer populations.

Discuss the cultural trends and any advantages and disadvantages a transition from hunter-gatherer to agriculture involved.

In your answer you should:

- describe the lifestyle of a hunter-gatherer and the lifestyle of an early farmer
- explain the cultural trends involved in the transition from hunter-gatherer to agriculture
- discuss any advantages and disadvantages a transition to agriculture from hunter-gatherer involved.

spread from home base. towns trading. tools plough sickle.

Around 10-12000 years ago, the lifestyle of hominins changed from hunter gatherer to farming. This change was driven by migration into new lands, replacement of populations and coupled by perfect timing of birds' development - allowing for the understanding of how to take care of and domesticate cattle and selectively breed wheat, cattle and so on. The lifestyle of a hunter gatherer was nomadic, following herds and leaving areas once the resources available

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there had been used. The lifestyle of a farmer was settled, domesticating and living off their own crops and farm animals.

The trends involved in the transition include a rapid increase in population size. As food was always available, and hunting which was a difficult task was no longer required, the death toll of people decreased. More who were older remained in relative safety at the 'home base'. The development of a 'home base' was another trend which increased the social aspect of their lives. Instead of carrying around all their belongings, they were left at a base in safety while the crops were tended / moved the cows. The home base led to a community feel which eventually led to townships. As less time was spent hunting, as resources were where they needed, the development of cultural evolution, art and spiritual aspects of their lifestyle also had a rapid increase. More time could be spent thinking, planning and communicating which subsequently led to a development in biological evolution. As people had more time, they started trialling and making errors in their tools

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4. environment was able to be manipulated and understood. This created a positive feedback ~~to~~ loop for the development of the brain and specialisation of endocranial features. The food developed allowed for the diet to switch from low-grade, tough, fibrous plant material to meat, bone marrow and seafood. Again, this addition in calories fuelled the brain expansion from 400-1400cc. Therefore, bipedalism was so significant because it allowed hands to be used to manipulate the environment and drive the rapid expansion of cultural and subsequent biological evolution.

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3. and pottery. This led to specialisation of different villages and further cultural development of ~~early~~ hominins. Also, as specialisation was prominent, trading between communities also became prevent- allowing for a wider range of foods / resources to be available in each village. Tool culture was also able to develop as specialised tools for farming, eg. sickle and plough were developed. ✓

✓ Disadvantages of this transition include that as the size of communities increased, the chance of epidemics / disease increased as many lived together. Also, the diet variety decreased as a group may only eat maize, causing the quality of diet to decrease. Food availability was dependent on weather conditions, thus, if there was a bad season, they were subject to death by starvation. Also, food was usually stored for winter, but this meant it was subject to infestation by weevils, mice etc and subsequent (mediability. finally, as the group size increased, the opportunity for conflict & fighting //

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Advantages in the development of agriculture meant more time could be spent socialising, imagining, thinking & this allowed for brain development - as less time was spent planning hunts/hunting. ~~There~~ Next, the food availability was more dependable as the resources weren't likely to diminish (although there's chance). Specialisation of roles and eventual leadership/government within communities was able to develop. Another advantage is the chances of death due to hunting decreased. Next // seen

Q2. plant material and subsequent softening resulted in the selection against large grinding molars, mandible and associated sagittal crest, nuchal crest, zygomatic arch and brow-ridge attachment - changing hominins biology. The fire allowed for extra calories ~~lost~~ locked within food to be discovered, allowing for the brain to be //

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provided with a much larger amount of calories, ~~eat~~ and as the jaw muscle and attachments decreased, the brain was able to expand. Now, the human brain at 2% of the body mass requires 20% of energy intake at rest, thus the food needed to be higher in calories to catalyse this development. Also, the endocranial features developed specialisation ie. Broca's area - for speech processing, wernicke for speech interpretation, cerebrum for planning, complex processing, and mathematics and the cerebellum for fine muscle coordination and balance. The use and development of tools also led to further biological development in humans as they were further able to understand the materials that surrounded them in the environment and also widen their diet. for example, H. habilis used the oldowan tool to crack marrow bones and eat the nutritious marrow in the centre, allowing for more nutrients to reach their brain and subsequent brain development. H. erectus used ~~food~~ a fish hook to encorporate omega 3 into their diet

See

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which was vital for the rapid brain expansion and specialisation, mentioned above.

over

This extra answer page MUST be placed inside the plastic bag with your answer booklet and handed in.

Excellence exemplar for 91606 2015			Total score	22
Q	**Grade score**	**Annotation**		
1	M6	This candidate gave clear explanations linking the skeletal features to the change to bipedalism. If the candidate had linked the skeletal features rather than bipedalism to the evolution of a larger-sized brain, the use of hands or energy efficiency they may have scored an E7 rather than an M6.		
2	E8	This is an E8 because the candidate includes an in-depth discussion on the effect of fire and the use and development of named tools associated with named hominins on their biological evolution.		
3	E8	The candidate provides enough evidence for E8 by linking the cultural trends associated with the change from hunter-gatherer to farmer with their associated adaptive advantages and disadvantages.		