Assessment Schedule – 2019

Biology: Demonstrate understanding of trends in human evolution (91606)

Evidence Statement.

Question One

Evidence	Achievement	Merit	Excellence
The pelvic bones become more bowl-shaped with a large surface area. The advantage of this is more attachment site for walking muscles (gluteus) and also support for torso when upright walking. As there was now more distance walking expected with the habitat change to less vegetation, this would aid the success of this. Feet changes show toes more in alignment. This would benefit thrust when walking, less energy in walking. Another change is the arch of the foot, offering support when walking. Arm ratio: the chimp has longer arms-to-legs, efficient for arboreal living. This ratio is reversed in the bipedal Australopithecine, as energy is most used from the legs. Foramen is slightly more centralised in australopithecine, which balances head without the need for muscles in bipedal walking. The valgus angle of the femur increased in the australopithecine, offering more support and less sway when walking bipedally – energy efficient. Changes in the spine shape to more of an S-shaped spine with curvature enables support from the stresses to the body in bipedal walking. Also it is a pillar for more even weight distribution, bringing the upper torso over the hips / allowing for more balance and acting as a shock absorber. Changes in environment such as lessening of forests could have seen the more bipedal stance selected for as energy efficient for longer distance walking. Selection of mate selection and the ability to carry more while moving.	• Description of **trends** in skeletal changes from information provided (up to 3). - Pelvis became more bowl shaped - Arm:leg ratio reversed in the Australopethcine - Foramen magnum became more centralised - An increase in the valgus angle - (see evidence for other changes) • Describes an **advantage** the skeletal change would bring about in bipedal walking. Eg. Shock absorption when walking on two legs OR Describes a **selection factors** that would have led to the changes, e.g. - Describes mate selection. - Describes change in forest areas to savannah.	• Explains **advantages** that named skeletal changes would bring about in walking bipedally (up to two). - For example, the trend seen in the valgus angle of the femur is that the angle increases. This advantage would be less energy use while walking as no swaying, therefore energy saving. - The change in spine shape to more of an S-shaped spine with curvature enables support from the stresses to the body in bipedal walking, also is a pillar for more even weight distribution / allows for more balance and is a shock absorber. - The arm / leg ratio with the australopithecines allows more propulsion when walking bipedally, which is more energy efficient (they also have long arms for tree climbing). (see evidence for other examples) • Explains **selection pressures** that resulted in a skeletal change (up to two). - E.g. a change in climate caused a change in vegetation. This causes a change in the habitat from fully forested to small pockets of trees to open grasslands. This could have seen the more bipedal stance **selected for** as energy efficient for longer distance walking. - (reference to thermoregulation as a selection factor is accepted).	• **Discusses trends in hominin evolution** by discussing how a named selection pressure in Africa may have influenced the evolution of the explained skeletal features allowing for successful bipedalism. Clearly links the advantage this change brought about in being bipedal. Selection pressures may be: - Climate influence on vegetation; those that were more bipedal with less sun on them (thermoregulation) during peak of day would more easily walk longer distances → more food - Mate selection; one theory is that the taller more aggressive looking could get more mates. May show breadth or depth of knowledge by ONE of the following: Linking together multiple changes in the one feature. • Discusses how the selection pressure enabled variation in form to be successful therefore increased survival, improved reproductive success and therefore carry on this trait to the offspring.

Not Achieved			Achievement		Merit		Excellence	
NØ = no response or no relevant evidence	N1 = 1 point	N2 = 2 points	A3 = 3 points	A4 = 4 points	M5 = 2 points	M6 = 3 points with brackets	E7 = any point	E8 = 2 points

Question Two

Evidence	Achievement	Merit	Excellence
Cultural evolution is the transmission of knowledge from generation to generation, not passed on by genetics, but by learning. Biological evolution occurs through genetic change and involves the transfer of DNA from one generation to the next Oldowan tools that *Homo habilus* used were simple, with only one face struck from a rock. However, this would give the ability to have a better diet, e.g. tubers, and therefore health and longevity. *Homo erectus* had Acheulian tool technology and with this could start a fire, preserving food for a migration with ease, and more longevity as less death by predators who would be scared by the fire or attacked with many axes. *Neanderthalensis* had a suite of tools from a variety of materials that would be used to make a shelter and also meant a lot more specialization to get a range of food, both lead to living longer. *Homo sapiens* in the Neolithic period built shelter, which meant we could settle and get a supply of food, this led to longevity except if there was disease, then there'd be less longevity as crowding began. Clothing linked to tools as it took a tool to take hide off an animal / other named use. Tools linked to gathering food as they can access food underground more easily and also be used to get into food and kill prey.	• Defines cultural evolution (see evidence) • Defines biological evolution (see evidence) • Describes a clear difference between BE & CE e.g CE occurs at a faster rate (up to two) • Description of tools (up to two): - *H. habilis*: Oldowan tools are stone tools that have had flakes struck off one side of a pebble. - *Homo erectus*: Acheulean tools are stone tools that have had flakes struck off two sides / tools that are biface with flakes removed from both sides. - Neanderthal: Mousterian tools are stone tools that have been made from large flakes / variety of materials used / Levallois method. - *H. sapiens:* Upper Paleo. very wide variety and finer e.g blades, hooks, putting two tools together. • Description of clothing or food (one only): - Describes clothing related to a named species e.g Neanderthal and hides - Describes a food that can be gathered by tool use e.g *H. habilis* and bone marrow.	Tool cultures linked to life span. • Explains how a named tool culture of the Palaeolithic (with dates / hominin) led to longevity, for example the Oldowan choppers used by *habilis* could have led to foods obtained from within bone or plants offering more calories → longer lifespan. • Explains how a second named tool culture of the Palaeolithic (with dates / hominin) led to longer lifespan. • Explains a change in clothing linked to a change in tools: e.g. Neanderthal clothing would have required tools sharp for the skinning of dead animals, therefore the tools of the day were needed for food gathering and for clothing. • Explains that increased success in hunting/food gathering requires a change in tool. E.g. *H. habilis* would have required a sharp tool to split open the bone to access marrow which increased nutritional value/more volume/continuous supply than was previously available	• Discusses changes to tool culture that have come about in the Paleolithic period and the advantages these changes could have brought to populations / species. - Has clear links for a named species and tool culture (described in-depth) →improved hunting / gathering → improved diet → increased lifespan/reproductive success - Has clear links for a named species and tool culture (described in-depth) →improved clothing →survive cold/move to new areas → longer lifespan/reproductive success - Could link tools to lessening lifespan at times (accidents / violence?).

Not Achieved			Achievement		Merit		Excellence	
NØ = no response or no relevant evidence	N1 = 1 point	N2 = 2 points	A3 = 3 points	A4 = 4 points	M5 = 2 point	M6 = 3points	E7 = any point	E8 = both points

Question Three

Evidence	Achievement	Merit	Excellence
Out of Africa theory involves australopithecines evolving into Homo species, no evidence of australopithecines leaving Africa. *Homo erectus* left Africa approximately. Nuclear DNA obtained from fossils and sequenced to obtain knowledge on chromosomes. It is used as it contains genes and coding regions that make us who we are. We can learn about what genes came about and when in our history. We can see what mutations came about and when in genes and in coding regions (e.g. lactose persistence gene). mtDNA is easier to find intact, as it is small and numerous. It is also sequenced and compared to present samples. As there is no recombination due to maternal inheritance, single nucleotide changes (SNPs) can be counted, and this gives a time from common ancestor. Areas that developed in the brain are the Broca's area for speech production; this helped in the cultural sharing of knowledge of tool marking and also increased longevity as individuals could communicate and warn others. Wernicke's area also enabled comprehension of speech and the frontal lobe development on the more recent hominin / s enable better tools and communication, as the hominin would predict how designs would work etc. This prediction and ability to imagine led to migration out of Africa and down to Australia, as this would be an easier route following the coast and up to Europe and into Asia.	• Describes the Out of Africa theory: *H. sapiens* developed in Africa and replaced earlier hominins (such as *H. erectus*/Denisovans/Neanderthals) • Describes uses of DNA and mtDNA/Y chromosome in adding knowledge of human ancestry (up to 3 only): - Mitochondria are inherited from the mother only (mtDNA) **or** Y chromosome from father only - Mitochondria/Y chromo: is used as a type of molecular clock / to work out time from divergence/no recombination - Nuclear DNA can be sequenced to look for genes. - Increase genetic variation indicates greater time since divergence • Endocranial (up to 3 only): - Broca's area for speech production - Wernicke's area important for comprehension - frontal lobe development for ideas. - allow other relevant area of the brain.	Explains DNA use: • Mitochondria are inherited from the mother only (mtDNA) as it is carried in the egg (the sperm mitochondria does not get through). So easy to see mutations over time would provide knowledge if groups from the same branch / mitochondria is used as a type of molecular clock / to work out time from divergence as mutations are added up (per site). • Y chromosomal DNA inherited from the father only and only undergoes limited recombination therefore can be used to work out time from divergence as mutations are added up. • Nuclear DNA can be gained and sequenced to look for genes to compare hominins and gather information on traits: Nuclear DNA would show similarity in genes and they could see what proteins the hominins share to work lineages out. • Explains brain area to migration: - Broca's area developed for speech production is important for long trips to keep group together / keep spirits up / allow for understanding in a big group. - Wernicke's area important for comprehension is important understanding directions, to get all going the same way / understand reason for movement. - frontal lobe development for ideas of migration / see consequences of actions / problem-solving, which would be important when crossing water ways. - allow other relevant area of the brain.	Discusses how the discovery of new species such as *Homo luzonensis* enables science to adjust the common understanding of the Out of Africa theory. • Includes links between the theory and what DNA could show e.g. that DNA would show us there was a separate migration before *Homo erectus* (Out of Africa theory) **AND** also what endocranial features tell us about the brain linked to the ability to successfully migrate out of Africa many years ago. Shows depth in the following: • Clear and concise knowledge of how mtDNA is used differently from nuclear DNA (this could include Y chromosomal DNA), i.e. looking at substitution mutations over generations. One for time of common ancestor, one for commonality in genes / proteins / traits.

Not Achieved			Achievement		Merit		Excellence	
NØ = no response or no relevant evidence	N1 = 1 point	N2 = 2 points	A3 = 3 points	A4 = 4 points	M5 = 1 point	M6 = 2 points (at least one from DNA & one from brain	E7 = any point	E8 = both points

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 12	13 – 18	19 – 24