Assessment Schedule – 2015

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

Evidence

Q	Evidence	Achievement	Merit	Excellence
ONE	Accept evidence from any 3 of the 4 skeletal features, but do not award extra points if a fourth is included. The difference in the structures reflects the different forms of locomotion. Quadrupeds use 4 limbs and bipeds use only the rear 2. • In hominins the foramen magnum is situated directly below or under the skull, so that it is centred and not at the back of the skull. • In hominins the pelvis is broad and flat or bowl-shaped. • In hominins the vertebral column is 'S' shaped. • In hominins the valgus angle is increased to bring the knees under the centre of the pelvis. The features have allowed the development of bipedalism because the skull can be held upright on the spine, enabling the centre of gravity and therefore balance to be centred through the body. The broader, flatter pelvis allows the weight of the upper part of the body to be supported and centred, so that it is balanced over the legs. The legs are able to move whilst maintaining a centre of gravity that falls through the body, avoiding the loss of balance whilst walking upright. The significance to the evolution of hominins was that bipedal locomotion was energy efficient compared to quadrupedalism, so that walking / running speed / distance to gather resources increased, and balance was better, which enabled resources / infants to be carried more efficiently. Upright walking left the hands free to use and manipulate objects. It also spread the weight of the head over the shoulders and enabled the brain to become larger and heavier within a larger cranial vault / skull. Brain development required improved nutrition,	• Describes quadruped as using 4 limbs for locomotion. AND describes biped as using 2 (rear) limbs / feet for locomotion. • Describes position of the foramen magnum in hominins as being directly under the skull or centred under the skull. • Describes the shape of the pelvis in hominins as being broad and flat or bowl-shaped. • Describes the spine as 'S'-shaped. • Describes how the valgus angle is increased to bring the knees under the centre of the pelvis. Describes a relevant biological development e.g. • The skull is held upright (centred) on top of the spine. • The pelvis is broad enough to support the upper torso. • The valgus angle is able to accommodate legs in an upright position / centres body weight through the middle of the pelvis when walking. • The 'S'-shaped curve brings the centre of mass over the feet / acts as shock absorber.	Explains how the **named skeletal features** support bipedalism. E.g.: • The more centred positioning of the foramen magnum, directly under the skull instead of to the back of the skull enabled the skull to be supported above the shoulders, instead of in front of them. This shifted the **centre of gravity**, which helped to **balance the skull** above the lower body. • The pelvis became reduced in length, so that it was wider and flatter. This improved the position of the **centre of gravity through the body** instead of the lower back. The broader pelvis could also support the upper body mass (without the need for support from the arms or knuckle walking). • The increase of the valgus angle produces	Justifies the significance of these skeletal changes on **evolution** of early hominins (N.B. Does **NOT** require the drivers of evolution eg. changing landscape) Discussion linking the **named skeletal feature** to the evolution of : • **brain size increase** AND **speech and language areas** The more centred positioning of the foramen magnum, and that skull was also able to become larger and heavier due to being better supported, allowed for a **larger size brain**, including the areas for speech recognition and speaking, the Broca's and Wernicke's areas. • **use of hands** The pelvis became reduced in length so that it was wider and flatter, freeing the hands for developing **manipulative skills**. **Then:** Brain development required improved nutrition, and this could be achieved with the use of tools that could be developed once the hands were free to manipulate materials. **OR:** Improved ability to transmit ideas and demonstrate things, so more ideas and knowledge could be communicated as it was accumulated. **OR:** Finer, more effective tools with more workmanship / development of art and artefacts. • **energy efficiency** 'S' curve in the vertebral column OR change in valgus angle

	and this could be achieved with the use of tools that could be developed once the hands were free to manipulate materials. Freeing the hands also led to improved ability to transmit ideas and demonstrate things, so more ideas and knowledge could be communicated as they were accumulated. Finer co-ordination of the hands and fingers, no longer needing them for balance, knuckle walking or holding onto structures, allowed the production of finer tools with more workmanship and development of art and artefacts. With increased brain development, also came the development of speech and understanding of speech, as the Broca's and Wernicke's areas developed within the larger cranial vault, allowing passing on of knowledge and tool-making techniques through verbal communication.		the 'knock-kneed' gait which brings the knees under the centre of the pelvis, so that **body weight is better balanced when walking upright.** • The development of an 'S'-shaped curve in the vertebral column brings the body's centre of mass directly over the feet, allowing **upright stance and movement as well as acting as a shock-absorber** (not spring) when walking or running.	- more energy efficient / biomechanically efficient bipedal locomotion so that walking / running speed / distance to gather resources increases and balance is better, which enables resources / infants to be carried more efficiently / thermoregulation.

Not Achieved			Achievement		Merit		Excellence	
NØ = TWO points.	N1 = THREE points.	N2 = FOUR points.	A3 = FIVE points.	A4 = SIX points.	M5 = TWO points.	M6 = THREE points.	E7 = TWO points.	E8 = THREE points.

Q	Evidence	Achievement	Merit	Excellence
TWO	Developing tools required a larger brain and strong precision hands. Because *Homo erectus* had the use of fire, it allowed them to stay awake longer into the evening to communicate ideas, develop and teach tool-making methods, and plan hunts. It also reduced disease; by cooking the meat, bacterial infections and disease in the community were reduced. The fire also acted as a deterrent to predators. As the tool culture developed, so did the brain size of the hominin. The *Homo habilis* brain casts show the expansion of the frontal lobe, which is important in the development of language called the Broca's area. The development of the early tools meant that the early Hominins such as *Homo habilis* had access to more protein, such as bone marrow, which the early choppers could have easily broken open. Access to protein and supplementing their diet with meat that they scavenged provided more energy required of a larger brain. *Homo habilis* are the earliest hominids that have a larger brain than the earlier hominins. This expansion meant this species had a higher ability to plan and to develop tools. Their tools were made from materials some distance away, which suggests that they 'planned' the manufacturing of tools in advance. The *Homo erectus* brain was larger than that of *Homo habilis*, and their tools showed more detail and thought in the way they were made, which required an ability to plan the shape of the tool before it was made. Along with more sophisticated tools, came a change in the foods eaten, and how these foods were obtained. While the australopithecines, and perhaps *H. habilis*, were essentially vegetarian, meat was a regular part of the erectus diet. There is also a possible causal link between the marked increase in cranial capacity of *Homo erectus* – especially the rapid rate of growth of the brain after birth – compared to its predecessors, and the regular presence of meat in erectus diets. The brain is a very fatty organ, and meat is a much better source of the necessary fats than plant foods. The high calorie content of meat is also important, as the brain is a	• Describes the correct order of the tools as Oldowan, then Acheulean tools followed by Upper Paleolithic. • Describes tool culture Fig 2 as oldowan, first used by *Homo habilis*. • Describes tool culture Fig 3 as acheulian associated with *Homo erectus* or other later archaic *Homo sapiens*. • Describes tool culture Fig 1 as Upper Paleolithic associated with *Homo sapiens*. • Describes fire is first associated with *Homo erectus* and later hominins. • Effect of fire / tools.	Explains the **trends** shown in the development of the tool cultures, AND how this shows a progression in the cultural evolution of the hominins OR explains the developments of tools and fire on the biological AND cultural evolution of the hominins. • Explains that Oldowan tools were less worked, the number of blows that were used to craft these tools were less (required little thought / planning / communication / language). They were made from pebbles and quartzite. • Explains Acheulian tools are more worked and are biface – two sides to the edge (this would take more abstract thought and planning). • Explains that the development of more complex Upper Paleolithic tools made from a variety of materials / various uses and requires thought / communication / language. • Explains the development and use of tools means that more protein rich food could be accessed. This type of food provides the energy required of a larger brain size. • Because the food was cooked, the proteins in the food were denatured and became softer meaning there was less need for large jaw muscles. • Fire killed bacteria on the food, reducing the effects of disease,	(Discussion must be related to the appropriate species and the correct tool.) Discusses the likely effects that **fire and the use and development of tools** had on the **biological evolution** of the hominins. • **development of language** and interpretation of language associated with the Wernicke area, which is used for the Broca's area that sends signals for movements required to produce speech. These areas are associated with the larger brain of the *Homo erectus*. The development of fire (which lengthened the day, allowing for transmission of ideas such as tool making, planning of hunting, and sharing of ideas) and tools coincides with the development of a larger brain in the hominins, which also means a development in the Broca's and Wernicke area, suggesting a development in the communication of the hominin species. • **increased cranial capacity through (fatty) meat** in diet Along with more sophisticated tools came a change in the foods eaten, and how these foods were obtained. While the australopithecines, and perhaps *H. habilis*, were essentially vegetarian, meat was a regular part of the *erectus* diet. There is also a possible causal link between the marked increase in

	very energy-hungry organ. Sites where fire was used are definitely associated with erectus . Hearth sites 790 000 years old, found in Israel, also contain the Acheulean tools produced by erectus. Learning to use fire in a controlled manner was a major step for our ancestors, because it gave them greater control over their environment and also had the potential to make available a far greater range of foods. Fire would not only offer protection from predators, but would also allow its users to survive in much colder environments. In addition, the controlled use of fire is evidence of the ability to plan ahead, and would also have aided social interactions as people gathered round the hearth.		leading to greater survival of individuals and a better chance in transmission of ideas.	cranial capacity of *Homo erectus* – especially the rapid rate of growth of the brain after birth – compared to its predecessors, and the regular presence of meat in *erectus* diets. The brain is a very fatty organ, and meat is a much better source of the necessary fats than plant foods. The high calorie content of meat is also important, as the brain is a very energy-hungry organ. • **Smaller molars** an adaptive advantage The trend in the molars getting smaller as the food that was being eaten was more processed by the tools and fire meant that the muscles and jaw required for processing harder, less processed food was selected against, while the trend of smaller molars and cusps were an adaptive advantage.

Not Achieved			Achievement		Merit		Excellence	
NØ = no response; no relevant evidence	N1 = 1 point, from Achievement.	N2 = 2 points from Achievement.	A3 = 3 points.	A4 = 4 points.	M5 = 4 points.	M6 = 5 points (First 3 bullet points for trends for all 3 tools required + 2 others).	E7 = 1 point (allow for one error on tool culture or species).	E8 = 2 points (all three tool cultures must be correct and linked where appropriate).

Q	Evidence	Achievement	Merit	Excellence
THREE	Hunter-gatherers were most likely nomadic, spending large proportions of their time searching for and collecting plant foods, hunting animals or scavenging carcases. Groups moved as resources changed, including both seasonal growth and migration of prey species. Agriculture (farming) would have involved a different way of life, from mobile and transient, to a settlement life, building permanent structures, domesticating animals, and cultivating crop plants. This produced a continuous food supply in one area. Agricultural lifestyle meant living in larger, more permanent groups, sharing tasks, developing the land, and physically changing the environment. Advantages would have been sharing workloads, greater safety, a more consistent supply of food, probably greater communication, greater transmission of tasks, benefits from more permanent shelters and living conditions. As the hunter-gatherers appear to have disappeared, the advantages seem to have outweighed the disadvantages. Disadvantages would have been: likely conflict between hunter-gatherers and farmers over hunting rights and land use, people living closer together may have caused greater transmission of disease. There may have been disputes over crop ownership and cultural practices. As farming became more established, people may have become more dependent on the steady supply of food, and may have lost the skills to hunt if and when the crops failed.	• **Describes hunter-gatherer.** E.g. they were most likely nomadic and spending large proportions of their time searching for and collecting plant foods / hunting animals / scavenging carcases. • **Describes agricultural lifestyle / farmer.** E.g. farming involved settlement and growing crops / domesticating animals / division of labour. • **Describes advantage.** E.g. farming provides a steady food supply / was probably safer. • **Describes disadvantage.** E.g. people close together spread disease / crops could fail.	**Explains cultural trends associated with the change in lifestyle.** E.g.: • To produce a continuous food supply in one area by growing crops and the domestication of animals. • Control of the breeding of certain plants and animals to develop desirable characteristics, such as more meat / milk, larger grains etc. • Development of permanent settlement sites including shelters / storing food / containing animals / deforestation. • An indication of trend towards greater division of labour / specialisation of skills / trade and commerce. • Increase in human settlement size due to greater safety / better protection from climate / more consistent supply of higher quality food.	**Discusses adaptive advantages and disadvantages as explained in cultural trends.** E.g.: **Advantages** • **Avoids need to move around and greater protection:** Farmers may have gained a cultural advantage by being able to produce food from their immediate environment through crop production and domestication of animals, avoiding the need to move around and gaining greater protection in early settlements from climate changes and the dangers of hunting. • **Better nutrition and availability of food** both through living food and stores (e.g. granaries) led to rapid expansion of populations and the development of villages into towns and towns into cities. Ready source of hides, wool, and other fibres for the production of clothing, containers, shelters, etc. • **Communication skills improve**: Trade and commerce and specialisation of skills led to the development of more complex communication and tools, as well as the need for abstract thought. **Disadvantages** • **Disease transmission and disputes**: likely conflict between hunter-gatherers and farmers over hunting rights and land use, people living closer together may have caused greater transmission of disease, as well as the possibility of crop disease etc. There may have been disputes over crop ownership and cultural practices. • **Crop failure:** As farming became more established, people may have become more dependent on the steady supply of food and reliance on what can be grown / kept. Dependence on other people as they may have lost the skills to hunt if and when the crops failed. (Due to bad weather or depleting the land.) **Overview** • The advantages must have outweighed the disadvantages, as farming persisted and hunting did not.

Not Achieved			Achievement		Merit		Excellence	
NØ = no response; no relevant evidence.	N1 = 1 partial point, e.g. one definition.	N2 = 1 point from Achievement.	A3 = 2 points (the 2 descriptions of hunter gatherer and farmer).	A4 = 3 points (must include the 2 descriptions of hunter gatherer and farmer).	M5 = 2 points.	M6 = 3 points.	E7 = 2 points. (must include at least one advantage and one disadvantage)	E8 = 3 points (One advantage and one disadvantage plus one other).

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 18	19 – 24