

Assessment Schedule – 2018

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

Evidence Statement

Question One

Evidence	Achievement	Merit	Excellence
<p>The features that assist <i>Homo naledi</i> as having the ability to walk bipedally are:</p> <ul style="list-style-type: none"> • Forward facing large toe which provides the thrust to push forward on (very similar to humans). • Long femur for long bipedal strides. • The knees are brought under the pelvis by the valgus angle, which means the center of gravity is supported for better balance and allowing one foot to be lifted while the rest of the body mass can be shifted to be balanced over the grounded foot. <p>The features that assist <i>Homo naledi</i> as having the ability to climb are:</p> <ul style="list-style-type: none"> • Shoulder joint is higher and more adapted for tree climbing and swinging from trees (it is more similar to <i>Australopithecus</i> than modern human). • Pelvis / ilium is flared outwards and is shorter from front to back than modern humans. This means less surface area for gluteal muscle attachment. • The fingers are curved, better adapted for grasping branches and climbing trees with a power grip. <p>Because the brain case is smaller, the brain could be less developed, more similar to older hominins like <i>Australopithecus</i>. The fingers are longer and more curved, which is more similar to older hominins, and are used for grasping branches. However, their thumb is longer much like <i>Homo sapiens</i>, which provides better dexterity for manipulation and precision. The shoulder is oriented slightly more forward and looks more like the <i>Australopithecus</i> than modern <i>Homo sapiens</i>. They have a forward-facing big toe, which provides thrust for bipedal movement very similar to</p>	<p>Describes three features that assisted in bipedal movement in <i>H. naledi</i>.</p> <p>e.g.</p> <ul style="list-style-type: none"> • Forward-facing big toe. • Long femur for long bipedal strides. • Valgus angle brings the centre of gravity above the knees. • S-shaped spine for balance or absorbs shock when walking. • Lower section of the pelvis is bowl shaped which resembles a modern human. <p>Describe three features that assisted <i>H. naledi</i> in tree climbing.</p> <ul style="list-style-type: none"> • Shoulder joint is high / more primitive / more similar to Australopithecines. • Upper section of the pelvis / ilium is flared outwards. • The fingers are more curved than <i>Homo sapiens</i>. • The collarbone and upper arm bone resemble corresponding Australopithecine bones. Their shape and robustness suggest they retained the ability to climb trees. • Arm length is longer in relation to <i>H. sapiens</i> to enable tree climbing (or similar). 	<p>Explains how the adaptations assist in bipedal movement in <i>H. naledi</i>.</p> <ul style="list-style-type: none"> • Forward-facing large toe which provides the thrust to push forward on (very similar to humans). • Long femur for long bipedal strides. More efficient in walking, as it requires less energy to travel long distances. • The knees are brought under the pelvis by the valgus angle, which means the center of gravity is supported for better balance and allowing one foot to be lifted while the rest of the body mass can be shifted to be balanced over the grounded foot. • S-shaped spine provides support and balance for the upright biped as weight of chest sits almost directly above the joint between spine and pelvis, rather than further forward. (This improves both balance and it absorbs the shock of walking). • Lower section of the pelvis is bowl shaped which allows <i>H. naledi</i> to balance the weight of the torso effectively over the hips <p>Explains features that assisted <i>H. naledi</i> in tree climbing.</p> <p>E.g.</p> <ul style="list-style-type: none"> • A more primitive shoulder joint 	<p>Justifies the evidences that suggests that <i>H. naledi</i> is an older hominin or more recent by comparing and contrasting.</p> <ul style="list-style-type: none"> • The fact that the hips and the smaller brain case are more similar to the Australopithecines than the <i>H. sapiens</i>, while the feet are more modern like the <i>H. sapiens</i>. • The thumb is longer and opposable, which indicates they could have used tools. But no tools to date have been found with <i>H. naledi</i> / • The thumb is longer and opposable, which provides more dexterity and is more similar to modern <i>H. sapiens</i> than an older hominin. • The flared hips and shorter front to back indicate that <i>H. naledi</i> is an older hominin on the estimated hominin phylogeny (EHP). The flaring of the ilium is more pronounced. This makes the hips more plate-like than bowl-shaped. This suggests that they were bipedal, because the iliac blades allow for the attachment of strong gluteal muscles and allowed side-to-side balance during walking. • Because the brain has not developed as much / / limited development and complexity as the modern human species. As it is only 560 cc and is closer to Australopithecus than modern humans with 1300 cc • The shoulder joint is oriented slightly more upwards, thought to help with holding the arms above the head for better tree climbing, providing more mobility when swinging between trees. This suggests that <i>H. naledi</i> is an

<p><i>Homo sapiens</i>. For these reasons it is likely that <i>Homo naledi</i> was around between 2 million years ago to 300, 000 years ago. Because they had features of both old hominins such as <i>Australopithecus africanus</i> and modern <i>Homo sapiens</i>.</p>	<ul style="list-style-type: none"> • Rib cage is wide / cone shaped which resembles the Australopithecines 	<p>enabled climbing and swinging from trees (it is more similar to Australopithecus than modern human)</p> <ul style="list-style-type: none"> • Pelvis / ilium is flared outwards and is shorter from front to back than modern humans. This means less surface area for gluteal muscle attachment • The fingers are curved, better adapted for grasping branches and climbing trees with a power grip. • Rib cage is wide / cone shaped (which resembles the Australopithecines) and this allows more room for movement of arms when climbing through the trees. 	<p>older hominin and was probably alive 2 million to 300 000 years ago.</p> <p>E.g.</p> <p>Because the brain case is smaller, the brain could be less developed, more similar to older hominids like Australopithecus. The fingers are longer and more curved, which is more similar to older hominids and are used for grasping branches. However, their thumb is longer, much like <i>Homo sapiens</i>, which provides better dexterity for manipulation and precision. The shoulder is oriented slightly more forward and looks more like the Australopithecus than modern <i>Homo sapiens</i>. They have a forward facing big toe, which provides thrust for bipedal movement very similar to <i>Homo sapiens</i>. For these reasons, it is likely that <i>Homo naledi</i> was around 300 000 years ago. Because they had features of both old hominins such as <i>Australopithecus africanus</i> and modern <i>Homo sapiens</i>.</p>
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Not Achieved			Achievement		Merit		Excellence	
NØ = no response or no relevant evidence	N1 = 1 or 2 points	N2 = 3 points	A3 = 4 points	A4 = 4 points 2 from bipedal and 2 from tree climbing	M5 = explained reasons why 3 named features have assisted with bipedal movement and / or tree climbing.	M6 = explained reasons why 4 named features have assisted with bipedal movement and / or tree climbing. 2 points with 2 points from bipedal and 2 points from tree climbing	E7 = compares 1-2 features that suggest that <i>H.naledi</i> share a common ancestor with <i>H. sapiens</i> referring to a place / timeframe in relation to other species	E8 = compares and contrasts 3 features that suggest <i>H.naledi</i> appears at a specific age in the phylogeny.

Question Two

Evidence	Achievement	Merit	Excellence
<p>Agriculture is the domestication of animals and the planting of plants as crops for food and increased productivity. While the division of labour is where individuals in a community become skilled at specific tasks and concentrate the majority of their time in those areas. The division of labour can be divided by sex and age as well as skills.</p> <p>Biological evolution is the transmission of physical, physiological, and behavioural adaptations passed on from parent to offspring in their genes. Whereas</p> <p>Cultural evolution is the transmission of ideas and behaviours from individual to individual and does not have to be from related individuals such as parent to offspring.</p> <p>By having a large brain, abstract thought was developed by biological evolution, and also being able to communicate ideas to coordinate activities such as hunting and defending against predators. This allows for greater success as a group and better access to food, which means there is more protein which is necessary to provide energy for a large brain.</p> <p>Having a large brain and being able to think abstractly and then communicate ideas meant that <i>Homo sapiens</i> could develop ideas such as ...</p> <p>Shelter – as <i>Homo sapiens</i> developed they changed from a predominantly hunter gatherer that followed the prey in their migratory routes to a fixed life style where they grew crops and domesticated animals</p>	<p>Describes cultural evolution and biological evolution.</p> <ul style="list-style-type: none"> • Biological (or genetic) evolution occurs through genetic change and reproduction and involves the transfer of genes from one generation to the next. • Cultural evolution The transmission of knowledge from generation to generation by teaching / learning or passing on of information that is not genetically derived. • Describes agriculture as: The domestication of animals / plants for food and increased productivity. • Describes abstract thought as: The ability to see and develop ideas that might not be obvious, eg see a calf drinking milk from a cow and then being able to milk a cow for food. • Describes the development of abstract thought as the result of the expansion of the frontal lobe / cerebrum / forebrain. <p>Describes the advantages of agriculture.</p> <ul style="list-style-type: none"> • Constant supply of milk, meat, seeds and fruit as living food does not spoil or go off. • Food supplies can be built up in times of plenty and stored for times of scarcity • Plants can be harvested when fruit is ripe, and animals killed and eaten 	<p>Explains how agriculture affected cultural evolution and biological evolution.</p> <ul style="list-style-type: none"> • Because of the development of agriculture, there is a steady supply of food such as milk / meat / fruit / seeds and can be kept longer because they are alive and growing in the area until required. This meant that the lifestyle changed from a nomadic lifestyle of following the prey around to settlement and permanent buildings (shelter). • Modern <i>Homo sapiens</i> were able to concentrate and develop their skills and technology in their respective roles eg using and training beasts of burden to carry heavy loads and with tasks like ploughing fields. This reduced the effects of selection pressures related to biological evolution linked to strength as the beasts of burden were able to be exploited to assist in this task. • The development of these tasks to providing an adaptive advantage for those who had this knowledge in their communities and therefore a greater chance of survival. • The greater chance of survival to the transmission of ideas to others by teaching and learning and not via genetics, therefore increases the rate of cultural evolution. • Greater effect of agriculture on cultural evolution than biological evolution as species started to develop culture to adjust to changes in their environment. Like the development of shelter and houses reduces 	<p>Discusses the advantages and disadvantages of agriculture in relation to cultural AND biological evolution of <i>Homo sapiens</i>.</p> <ul style="list-style-type: none"> • <u>Links</u> the explanation of positive feedback (abstract thought) to development of agriculture and <u>then links</u> this to the advantages of agriculture outweighing disadvantages, which leads to greater survival and reproductive success. <p>E.g.</p> <p>With the development of the large, complex, highly organised brain that characterises modern humans, only when this reached a certain critical level of development did significant cultural evolution become possible. Cultural change then provided a stimulus for further increase in brain size, complexity, and organisation – biological and cultural evolution became linked in a positive feedback cycle.</p> <p>As the forebrain (cerebral cortex) developed, so did the ability of the <i>H. sapiens</i> to think abstractly and use the beast of burden to help with tasks that could improve productivity like ploughing the fields and carrying heavy loads. Also aided in developing horticultural practices in growing crops and storing food. One disadvantage of domesticating animals is the amount of waste and the spread of disease associated with this practice. However, the advantages of using this form of cultural evolution must outweigh the disadvantages, and there must be a higher rate of survival among those who practised this form of cultural evolution than those who did not.</p> <p>This provides a greater chance of survival as <i>H. sapiens</i> have more access to food resources and <i>(Provides named examples of advantage of agriculture and one named example of a</i></p>

<p>to be able to have the food available when required. This provided more time to develop in other areas, such as toolmaking specifically for horticulture and processing the food such as a grinding stone etc.</p> <p>As their settlements developed, people became more skilled at farming.</p> <p>Permanent settlements formed, especially near sources of water needed for themselves and their animals and plants. Settlements were accompanied by important changes in social organisation. People had time to develop other activities and skills, such as pottery, art, herbal medicines, sport, and music. Division and specialisation of labour occurred, as not everyone was needed to ensure a community had sufficient food on a daily basis. Occupations such as carpenters, potters, cooks, servants, and priests came into existence (with services traded for food within or between communities). Surplus food could also be traded for other types of food (e.g. beef for fish or shellfish; different fruits), or for resources such as materials for tools (e.g. obsidian, flint, clay, antlers, bone) or for making clothes (e.g. hides, wool). Tool technology developed apace; a milestone development was the quern-stone used to grind grain into flour.</p> <p>Initially in settlements that developed agriculture, people's diets became less diverse and provided a lower grade of nutrition than was obtained as a hunter-gatherer.</p> <p>The biological development of the brain allowed the cultural developments which reinforced the biological evolution having a positive feedback.</p>	<p>when they are young.</p> <ul style="list-style-type: none"> • Ready source of hides, skins, wool for the production of clothing and shelter. • Beast of burden – animals can be used to carry heavy loads – increases productivity. • Fewer people were required to tend to domestic plant and animals. • Individuals not involved in food gathering could develop other skills. <p>Describes the disadvantages of agriculture</p> <ul style="list-style-type: none"> • Diet may become less diverse as it is restricted to what can be grown. • Weather is a major factor as it influences the yield of the crop and domesticated animal. • Increased waste production from humans and their domesticated animals increases the risk of disease. 	<p>the effect of environmental selection pressures that can be developed</p> <ul style="list-style-type: none"> • Positive feedback with the development of the large, complex, highly organised brain that characterises modern humans. Such as the development of the cerebral cortex, where the hominins like <i>H. sapiens</i> were able to develop abstract thought and cultural change then provided a stimulus for further increase in brain size, complexity, and organisation – biological and cultural evolution became linked in a positive feedback cycle. <p>Effect of agriculture on biological evolution</p> <ul style="list-style-type: none"> • By developing agriculture, populations are exposed to selection pressures linked to diet such as milk. In the areas that developed the use of milk as a food source (cultural evolution), have developed an enzyme (lactase) used in children to break down milk fats (biological evolution) in adults. Areas without the agriculture development of the use of milk were not exposed to this selective pressure, and they did not have this enzyme and are lactose intolerant as they did not evolve biologically. • As they were better able to build up food supplies in times of plenty and stored for times of scarcity. Reducing the effect of the environment on biological evolution. • Those individuals / communities with the ability for future planning / forward thinking skills in reference to e.g food storage more more likely to survive and pass on these traits. <p>Explains the effects of agriculture on cultural evolution.</p> <ul style="list-style-type: none"> • By having individuals better skilled at 	<p><i>disadvantage of agriculture. And stating that the advantages outweigh the disadvantages, providing an adaptive advantage for H. sapiens and, therefore, better survival rates)</i></p> <p>This meant that a nomadic lifestyle of following the herds as hunter-gatherers changed to fixed settlements developed, and communities became more efficient at producing food for the community and developing tools and skills for other areas.</p> <p>Discuss the advantages and disadvantages of shelter in relation to cultural and biological evolution of <i>Homo sapiens</i>.</p> <p>Links advantages of agriculture to the ability to live in a fixed settlement and to the ability to reduce the effect of selective pressures of hunter gathering and were selective towards a better development in cultural evolution. By building permanent shelters the individuals were better able to survive the extremes in the environment and were still able to survive off their living.</p> <p>Advantages</p> <ul style="list-style-type: none"> • As people became more skilled at farming, permanent settlements formed, especially near sources of water needed for themselves and their animals and plants. Settlements were accompanied by important changes in social organisation. People had time to develop other activities and skills, such as pottery, art, herbal medicines, sport, and music. • Division and specialisation of labour occurred, as not everyone was needed to ensure a community had sufficient food on a daily basis. Occupations such as carpenters, potters, cooks, servants and priests came into existence (with services traded for food within or between communities). Surplus food could also be traded for other types of food (e.g. beef for fish or shellfish; different fruits), or for resources such as materials for tools (e.g. obsidian, flint, clay, antlers, bone) or for making clothes (e.g. hides, wool). Tool technology
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		<p>tasks like toolmaking, growing crops like wheat, rearing animals etc. lives are organised around cooperation, which becomes complementary in helping each other to survive.</p> <ul style="list-style-type: none"> • Better use of time: more time is gained for other activities like the arts and the development of skill, improving cultural evolution. 	<p>developed apace; a milestone development was the quern-stone used to grind grain into flour.</p> <p>Disadvantages of shelter</p> <ul style="list-style-type: none"> • Because people lived closely together, they are more exposed to the transmission of disease in a community due to accumulation of wastes and toxins / or could use conflicts as an example / Living in a community brings in scavengers and large predators. <p>Highest % of adult lactase enzyme linked to lactase hotspot named places on graph linked to biological evolution being affected by cultural evolution.</p> <ul style="list-style-type: none"> • The lactase enzyme is highest in Europe where 90 to 100 % have this enzyme that enables them to break down lactose. Areas that did not develop agriculture until later have a lower % of the adult population being able to break down lactose, because they have not had the same selection pressure in selecting for individuals that have the lactose allele mutation that allows for the exploitation of dairy products such as cheese. This is a form of biological evolution that has been influenced by cultural evolution of dairy farming / agriculture.
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Not Achieved			Achievement		Merit		Excellence	
NØ = no response or no relevant evidence	N1 = 1 point	N2 = 2 points (any)	A3 = 3 points (any) (max. 2 A points from advan & disadv.)	A4 = 4 points	M5 = 3 bullet points of any cul and / or biol evolution (refer to 2 / 3 abstract thought / food / shelter)	M6 = 4 bullet points of 2 cul & 2 bio (refer to 2 / 3 abstract thought / food / shelter)	E7 = 2 advan / disadv OR thorough lactase example	E8 = 3 points (at least 1 advan and 1 disadv which includes outweigh + positive feedback)

Question Three

Evidence	Achievement	Merit	Excellence
<p>The Multiregional Model contends that after <i>Homo erectus</i> left Africa and dispersed into other portions of the Old World, regional populations slowly evolved into modern humans. This model contains the following ideas:</p> <ul style="list-style-type: none"> • Some level of gene flow between geographically separated populations prevented speciation, after the dispersal. • All living humans derive from the species <i>Homo erectus</i> that left Africa nearly two million years ago. • Natural selection in regional populations, ever since their original dispersal, is responsible for the regional variants (sometimes called races) we see today. • The emergence of <i>Homo sapiens</i> was not restricted to any one area but was a phenomenon that occurred throughout the entire geographic range where humans lived. <p>The Out of Africa Model asserts that modern humans evolved relatively recently in Africa, migrated into Eurasia and replaced all populations which had descended from <i>Homo erectus</i>. Critical to this model are the following ideas:</p> <ul style="list-style-type: none"> • After <i>Homo erectus</i> migrated out of Africa the different populations became reproductively isolated, evolving independently, and in some cases like the Neanderthals, into separate species. • <i>Homo sapiens</i> arose in one place, probably Africa (geographically this includes the Middle East). • <i>Homo sapiens</i> ultimately migrated out of Africa and replaced all other human populations, without interbreeding. • Modern human variation is a relatively recent phenomenon. <p>Investigation of the patterns of genetic variation in modern human populations supports the view that the origin of <i>Homo sapiens</i> is the result of a recent event</p>	<p>Describes the dispersal theories and the evidences.</p> <ul style="list-style-type: none"> • Describes the Multiregional Model: <i>H. erectus</i> left Africa into different areas of Europe / Asia and these hominins slowly evolved into <i>H. sapiens</i> in their separate regions. • Describes the Out of Africa / Replacement Model: <i>H. sapiens</i> developed in Africa and replaced earlier hominins such as <i>H. erectus</i> / <i>neanderthalensis</i> <p>Evidence for theories:</p> <p>Describes genetic diversity decreases away from Africa.</p> <ul style="list-style-type: none"> • There was interbreeding between <i>Homo sapiens</i> leaving Africa and the Denisovans and Neanderthals. <p>Describes how cultural evolution helps with dispersal:</p> <ul style="list-style-type: none"> • They would have had tools to exploit the resources found in the areas that they are moving into. • Having fire to be able to keep warm allows better chances of survival. • Being able to communicate provides ability to navigate best paths and to transmit this knowledge horizontally to unrelated individuals. 	<p>Explains the dispersal theory and the evidences.</p> <p>(Explains why the MR or OOA Model is best supported by evidence.)</p> <ul style="list-style-type: none"> • Explains the interbreeding between archaic African hominins and <i>Homo sapiens</i>, Neanderthal breeding with <i>Homo sapiens</i>, and Denisovans breeding with <i>Homo sapiens</i>. • The genetic diversity is greatest in African populations as these populations have had more time to accumulate variation where the other populations are younger the further away they are from Africa, so they have had less time to accumulate variations in the population. • The useful FOXP2 gene would have helped in <i>Homo sapiens</i> migration as they would have been able to explain best routes and times to travel and pass this on through verbal communication <p>OR</p> <p>The SRGAP2 gene is found in <i>Homo sapiens</i>, Neanderthals and Denisovans. The language and conscious thought could have given the</p>	<p>Discuss how cultural evolution and biological evolution may have supported human dispersal.</p> <p>For the moment, the majority of anatomical, archaeological and genetic evidence gives credence to the view that fully modern humans are a relatively recent evolutionary phenomenon. The current idea (best explanation) for the beginning of modern humans is the Out of Africa Model that postulates a single, African origin for <i>Homo sapiens</i>:</p> <p>Discusses how biological evolution may have supported human dispersal.</p> <ul style="list-style-type: none"> • The FOXP2 gene and the SRGAP2 gene facilitated the ability to think and communicate with others the best route when migrating. The biological evolution specific proteins that help with language help with the cultural evolution of language, and the transmission of ideas linked best migration routes to water availability which would provide a greater success for migrating populations. • The biological evolution like EPAS1 means that the <i>Homo erectus</i> and <i>Homo sapiens</i> had the ability to manipulate tools and have the dexterity to use fire. This allowed <i>H. sapiens</i> to use tools made of flint. Being able to manipulate fire would provide warmth and safety from predators. This would have allowed the movement into colder regions north. • Because <i>Homo sapiens</i> interbred with Neanderthals and the Denisovans, they had developed the HLA gene. In some of the young offspring this gene produces a protein that helps white blood cells destroy micro-organisms. Helps to reduce the effect of

<p>that is consistent with the Out of Africa Model.</p> <ul style="list-style-type: none"> The genetic diversity is greatest in African populations as these populations have had more time to accumulate variation where the other populations are younger the further away they are from Africa, so they have had less time to accumulate variations in the population. 		<p>modern <i>Homo sapiens</i> the advantage of being able to make reasoned choices for migration that were critical for success</p> <p>OR</p> <p>The HACNS1 gene provides the opposable thumbs and ability to manipulate tools necessary to ensure success in the migration of <i>Homo sapiens</i>, like being able to have sophisticated tools and the ability to build rafts to migrate to different parts of the world.</p> <p><i>Explains how cultural evolution helps with dispersal. (Named hominin + tool + use linked to ability to survive on the journey.)</i></p> <ul style="list-style-type: none"> Using Acheulean tools like a hand axe means they are able to butcher animals along the way for food / clothing. Use fire to keep warm / keep predators away in unknown territory as well as cook food to keep healthy and avoid sickness on the journey to allow better chances of survival as they disperse into new areas. 	<p>disease that could affect the individuals migrating.</p> <ul style="list-style-type: none"> By interbreeding with the Denisovans, the hybrids would have the EPAS1 gene. As this population grows they would have the gene that enables them to deal with high altitudes when migrating through high altitude regions. It is likely that the Out of Africa Model is more correct, and this is supported by more genetic variation in Africa, which decreases as the distance increases from Africa. This confirms that the populations in Africa had more time to accumulate genetic variation, whereas the other populations have had less time to accumulate these genetic variations. This indicates that they are relatively young populations. The younger the population, the lower the genetic variation. <p>Discusses how cultural evolution may have supported human dispersal.</p> <p>Links (2 of the 3 below)</p> <ul style="list-style-type: none"> The ability to communicate would be an advantage in communicating good routes to take. This would lead to more successful movements of <i>Homo erectus</i>. The ability to use stone tools such as the hand axe gives the opportunity of <i>H. erectus</i> to butcher animals and use skins and hides to provide warmth in colder regions. The ability to use fire would provide the opportunity for <i>erectus</i> to escape predators in the night and keep warm in cooler regions as well as discuss the direction and path of possible routes and direction of herds they may have been hunting.
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Not Achieved			Achievement		Merit		Excellence	
NØ = no response or no relevant evidence	N1 = 1 point	N2 = 2 points from Achievement	A3 = 3 points	A4 = 4 points	M5 = 2 points from Merit (allow only one gene reference)	M6 = 3 points	E7 = 1 point from Excellence	E8 = 2 points (one of cul + 1 of bio + states OOA as the “best” explanation)

Cut Scores

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