

SUGGESTED TEXTBOOK ANSWERS**Chapter 20 Cultural evolution**

The following are suggested answers only. Other answers to the same questions may also be correct.

Science inquiry**Activity 20.1 Are humans unique?**

With a partner, try to draw up a list of features that are unique to humans. Consider all aspects of humanity in your discussion – physical characteristics, behaviour, human achievements and others. Do some of the features selected follow an evolutionary trend? Are these features likely to evolve further in the future?

Have a class discussion on the lists proposed by the various pairs in the class and try to agree on a class list. Be prepared to criticise others, but do so in a constructive way. It is more important to be involved in actively thinking about the topic than in arriving at a correct answer. In fact there may be very few points on which the whole class will agree.

Answer: Students will suggest a range of characteristics that may, or may not, be correct, but will contribute to stimulating discussion. The points listed below are not necessarily unique to humans, but could be used as starting points for a class discussion.

- Striding gait
- Large and complex brain, especially the cerebrum
- Precision grip
- Complex culture that is communicated to each succeeding generation
- Sophisticated tool use including highly complex technology
- Ethics and values, or a moral sense
- Religious belief
- Spoken and written language
- Abstract thought and symbolism
- Sharing information

See <http://www.psychologytoday.com/blog/minds-animals/200907/are-humans-unique> for an article that could also be used in class debate.

Activity 20.2 Chimpanzees, Neanderthals and humans**What to do**

- 1 Based on the information in Table 20.2, which individual is most closely related to the Neanderthal and which is the least?

Answer: The most closely related is human 1, because there are fewer nucleotide differences in the mitochondrial DNA than any of the other individuals. The least related is chimpanzee 1, because it has more nucleotide differences than any of the other individuals.

- 2 The Neanderthal mitochondrial DNA was extracted from a fossil 25 000 years old. What other information obtained from the fossil would be valuable in determining the evolutionary relationships of the Neanderthal with chimpanzees and humans?

Answer: Where it was found – type of sediment and associated fossils that could give a guide to climatic conditions; what was found with the fossil – artefacts, bones from other species, charcoal, evidence of shelter; cranial capacity – and shape of cranium; shape of jaw; tooth size and arrangement; structure of pelvis and lower limb

- 3 What dating methods could be used to determine the absolute age of the Neanderthal fossil?

Answer: If the fossil was 25 000 years old, radio-carbon dating could have been used.

- 4 What methods could have been used to determine a relative age for the Neanderthal fossil?

Answer: Stratigraphy (the principle of superposition) and/or fluorine dating could provide an age relative to other items found in the area.

Review questions

- 1 a What was the importance of meat eating to the future survival and evolution of the hominins?

Answer: Meat eating became important in providing higher energy requirements and the fats needed for bigger hominins with larger, more complex brains. The complex fats needed for brain growth are difficult to obtain on a vegetarian diet.

- b How did tool manufacture and use contribute to this survival?

Answer: Tools were probably first used to hack away meat from scavenged carcasses, and then used in the hunting and slaughtering of animals. In this way more food would have been obtained than in just trying to rip flesh from bones with the bare hands. Tools were possibly also used in defence from predators.

- 2 *Homo erectus* (and the contemporaries of *H. erectus*) appears to be the first hominin to have used fire in a systematic way. List the ways in which fire could have improved their way of life, giving examples where appropriate.

Answer: Use of fire could have assisted hominins in the following ways.

- Hunting – directing and trapping animals to kill for food
- Deterrent – keep predators away
- Light – increased the length of the day which allowed for increased social activity at night – leading to cultural activities and rituals around the fire
- Warmth – allowed survival in cold environments
- Cooking – increasing safety of food, taste and digestibility, and the range of foods that could be eaten

- 3 Describe the significant cultural advance that occurred with the development of the Mousterian tool-making industry.

Answer: Mousterian tool culture was characterised by the production of flakes of stone from a disc-shaped core. Flakes were used for preparing animal hides and making clothing. In this indirect way, Mousterian tools enabled Neanderthals to live in colder climates.

- 4 a It is known that the Denisovans were a distinct group of ancestors of modern humans but we do not know anything about their appearance or their culture. Explain why this is so.

Answer: The only evidence of the Denisovans that had been found by early 2015 were a fragment of a finger bone, a tooth and a toe bone. Although it was possible to analyse the fossils for mitochondrial DNA, such meagre fossils can give no indication of physical structure or culture. Until more fossils are found, along with artefacts, the appearance and culture of these people will remain a mystery.

- b How is the Denisovan story an interesting reversal of the usual order of discoveries?

Answer: As mentioned above, we have no evidence of the physical or cultural characteristics of the Denisovans, but we do know about them from their DNA. Usually fossils and artefacts are found first, so that a picture of the people can be built up. It is only later that their DNA is analysed.

- 5 a Who were the Red Cave Deer people and where did they live?

Answer: The Red Cave Deer people were found in China and have a combination of quite primitive features and others that are quite modern. Some scientists have suggested that they are related to the Denisovans.

- b Only a few fossils of these people have been found. Why do experts believe they were a distinctive group of people?

Answer: The scientists who discovered the fossils described them as anatomically unique in that they had a combination of archaic and very modern features. The distinctive features that differed from modern humans were a short, flat face, a broad nose, a jutting jaw with no chin, large molars, prominent brow ridges, and thick skull bones.

- 6 Differentiate between the three tool-making traditions of the Cro-Magnons. List their age ranges and the tools that characterised them.

Answer:

Tool making tradition	Age range	Types of tools
Aurignacian	43 000 to 26 000 years ago	Blade tools for cutting and scraping
Solutrean	22 000 to 19 000	Delicate laurel and willow-leaf points; probably decorative rather than used as tools
Magdalenian	18 000 to 12 000	Bone and antler tools, rather than stone

Note: age ranges for tool cultures are very approximate.

- 7 Why do scientists believe that the laurel-leaf blade may have been an ornament rather than a spear-point?

Answer: Laurel leaf blades were so finely crafted and delicate that they would have broken if used in the way that other tools would have been used.

- 8 Cro-Magnon people appear to be among the world's first artists. Describe the two forms of art made by these people, and comment on the possible significance of art to their daily lives.

Answer: The two forms of art were cave paintings, known as mural art, and portable art, which could be carried, such as decorated tools or models of figures. Art could have enhanced their daily lives by contributing to communication, acting as a means of record keeping, or perhaps for pleasure. In creating such art, tool-making skills and cognitive ability would have been enhanced.

- 9 The hunter-gatherer way of life characteristic of the Cro-Magnon people was gradually replaced by an agricultural one.
- a List the regions where agriculture is first thought to have developed.
Answer: South-West Asia (Palestine and other Middle Eastern countries); China; Central America
- b What factors contributed to the replacement of the hunter-gatherer way of life by an agricultural one?
Answer: Factors that may have contributed are:
- population pressures – the need to produce more food for a rising population
 - the discovery of suitable plants for growing as crops
 - suitable animals for domestication
 - hybridised grain for cropping and harvesting
 - facilities for storage of food
 - the ability to construct more permanent dwellings.
- 10 Explain how the characteristics of the hybrid wheat emmer, and subsequent hybrids, enabled the development of agriculture.
Answer: Emmer, and the later hybrids, produced larger grains and heads, and the grain did not disperse in the wind. These characteristics enabled the development of agriculture because the heads were easier to harvest and the large grains were suitable for grinding.
- 11 Give two reasons for studying primate and hominin evolution.
Answer:
- To define what it means to be human
 - Curiosity and the acquisition of knowledge
 - To understand modern humans
 - To understand the past as an aid to understanding the present, and making future decisions

Apply your knowledge

- 1 Australopithecines may have been the first hominins to manufacture tools for a specific purpose. Describe the significance of this development in food gathering for later hominin evolution.
Answer: As Australopithecines became more dependent on tools for survival, natural selection would have favoured a more efficient precision grip. Tool use would have allowed them to make use of a wider range of habitats, and thus an increased range of foods could be gathered. It therefore became possible to migrate out of Africa into Europe and Asia. These new environments would have presented new physical and intellectual challenges. Individuals with larger brains and better problem-solving skills would have been more likely to survive and so, with natural selection, a larger brain would have evolved.

- 2 For the past 100 000 years at least, hominins have adapted culturally to environmental change. Refer back to Chapter 14. Does natural selection affect cultural characteristics?

Answer: Cultural characteristics are not inherited; they are learned. Thus, the selection of favourable alleles is not directly involved in cultural evolution. However, the ability to learn is inherited, so natural selection could be indirectly involved. Epigenetic factors (see *Human Perspectives* ATAR Units 1&2) could also be involved in the inheritance of some cultural characteristics.

- 3 There is some speculation among scientists that the large brain of *Homo erectus* would have required offspring to be born at a very early stage to allow the passage of the large head through a relatively narrow birth canal. Discuss the implications that the care of helpless young would have had for the social behaviour of *Homo erectus*.

Answer: Monogamy, or a family group situation, would have been needed so that the mother and her helpless infant could be nurtured. Childbirth would have meant that new mothers could no longer be productive members of the group, so that cooperative behaviour would have been essential. Establishment of a home base may also have been necessary, because it would be difficult to constantly carry small helpless infants from place to place and to ensure their survival.

- 4 Briefly outline the technological advances in tool making from the early Oldowan industry to that of Magdalenian times.

Answer:

- Earliest tools are Oldowan. Rounded pebbles with one or two pieces chipped off.
- Acheulian tools were used by *H. erectus*. They are large hand axes chipped around all edges into a teardrop shape.
- Mousterian tools were used by Neanderthals. These were the first flake tools produced by striking flakes of stone off a larger core using another piece of stone. Flakes were then sharpened or shaped into a variety of tools.
- Aurignacian tools, made by early Cro-Magnon people, were mostly chipped to form blades.
- Solutrean tools are very finely chipped, and may have been ornamental rather than functional.
- Magdalenian tools produced by later Cro-Magnon people were mostly made from antler and bone, rather than stone. The antler and bone were worked using a stone burin – a tool for making other tools. The making of a tool to make other tools was a major cultural step.

- 5 Why would early humans have made portable art? Suggest possible reasons for this type of activity.

Answer: Portable art could be easily carried around, and may have been used while groups of early humans were relocating their home bases according to the seasons. They are also likely to have been associated with religious beliefs, and may have been carried for ‘protection’ – much as people might carry a lucky charm today.

- 6 Useful cereal crops produce seed that does not break up in the wind. Outline the disadvantages of cereal crops with seeds that could be wind-dispersed, and the advantages of those with seed heads that stayed intact.

Answer: Wind dispersed seed would have to be very light, and would therefore contain little nourishment. Seed heads that stayed intact would have two advantages – the seeds would have been larger and better for nutrition, and the intact heads would have made it much easier to harvest the seeds.

7 If you were living around 11 000 years ago, what characteristics would you have looked for in animals with a view to trying to domesticate them for meat production?

Answer: Desirable characteristics could include:

- docile behaviour
- relatively small and easy to handle, easy to catch
- a lot of muscle (meat)
- able to provide resources other than meat – milk, hides, wool and so on
- not solitary – able to be herded
- able to be tethered or fenced.

8 An article published in 2008 described how orang-utans could help each other get food by trading tokens. Read the article at the weblink and discuss whether this is an example of cultural evolution.

Answer: Arguments that support cultural evolution include the following.

- The orangs are not just trading; they have learned a value system.
- The orangs have learned to cooperate which is not something they would normally do.
- There is evidence of behaviour being adapted to a new situation.

Arguments against cultural evolution include the following

- Orang-utans were just using their innate intelligence.
- The orang-utans were being taught by humans – the behaviour had not evolved.
- More than one generation would need to be studied to demonstrate evolution.