Population Movements and Genetics

14 **A** Study of the origins and distribution of human populations used to be based on archaeological and fossil evidence. A number of techniques developed since the 1950s, however, have placed the study of these subjects on a sounder and more objective footing. The best information on early population movements is now being obtained from the 'archaeology of the living body', the clues to be found in genetic material.

15 **B** Recent work on the problem of when people first entered the Americas is an example of the value of these new techniques. North-east Asia and Siberia have long been accepted as the launching ground for the first human colonizers of the New World. But was there one major wave of migration across the Bering Strait into the Americas, or several? And when did this event, or events, take place? In recent years, new clues have come from research into genetics, including the distribution of genetic markers in modern Native Americans.

16 **C** An important project, led by the biological anthropologist Robert Williams, focused on the variants (called Gm allotypes) of one particular protein - immunoglobin G- found in the fluid portion of human blood. All proteins 'drift', or produce variants, over the generations, and members of an interbreeding human population will share a set of such variants. Thus, by comparing the Gm allotypes of two different populations (e.g. two Indian tribes), one can establish their genetic 'distance', which itself can be calibrated to give an indication of the length of time since these populations last interbred.

17 **D** Williams and his colleagues sampled the blood of over 5,000 American Indians in western North America during a twenty- year period. They found that their Gm allotypes could be divided into two groups, one of which also corresponded to the genetic typing of Central and South American Indians. Other tests showed that the Inuit (or Eskimo) and Aleut formed a third group. From this evidence it was deduced that there had been three major waves of migration across the Bering Strait. The first, Paleo-Indian, wave more than 15,000 years ago was ancestral to all Central and South American Indians. The second wave, about 14,000-12,000 years ago, brought Na-Dene hunters, ancestors of the Navajo and Apache (who only migrated south from Canada about 600 or 700 years ago). The third wave, perhaps 10,000 or 9,000 years ago, saw the migration from North-east Asia of groups ancestral to the modern Eskimo and Aleut.

18 **E** How far does other research support these conclusions ?
Geneticist Douglas Wallace has studied mitochondrial DNA in blood samples from three widely separated Native American groups: Pima-Papago Indians in Arizona, Maya Indians on the Yucatan peninsula, Mexico, and Ticuna Indians in the Upper Amazon region of Brazil. As would have been predicted by Robert Williams's work, all three groups appear to be descended from the same ancestral (Paleo-lndian) population.

19 **F** There are two other kinds of research that have thrown some light on the origins of the Native American population; they involve the study of teeth and of languages. The biological anthropologist Christy Turner is an expert in the analysis of changing physical characteristics in human teeth. He argues that tooth crowns and roots have a high genetic component, minimally affected by environmental and other factors. Studies carried out by Turner of many thousands of New and Old World specimens, both ancient and modern, suggest that the majority of prehistoric Americans are linked to Northern Asian populations by crown and root traits such as incisor shoveling (a scooping out on one or both surfaces of the tooth), single-rooted upper first premolars and triple-rooted lower first molars.

According to Turner, this ties in with the idea of a single Paleo-lndian migration out of North Asia, which he sets at before 14,000 years ago by calibrating rates of dental micro-evolution. Tooth analyses also suggest that there were two later migrations of Na-Denes and Eskimo- Aleut.

G The linguist Joseph Greenberg has, since the 1950s, argued that all Native American languages belong to a single 'Amerind' family, except for Na-Dene and Eskimo-Aleut - a view that gives credence to the idea of three main migrations. Greenberg is in a minority among fellow linguists, most of whom favour the notion of a great many waves of migration to account for the more than 1,000 languages spoken at one time by American Indians. But there is no doubt that the new genetic and dental evidence provides strong backing for Greenberg's view. Dates given for the migrations should nevertheless be treated with caution, except where supported by hard archaeological evidence.

Question 14-19

Reading Passage 2 has seven paragraphs, ***A–G***

Choose the correct heading for paragraphs ***A- F*** *from the list of headings below.*

Write the correct number, ***I- X,*** *into boxes 14-19 on your answer sheet.*

List of Headings

Ⅰ. The results of the research into blood-variants

Ⅱ. Dental evidence

Ⅲ. Greenberg's analysis of the dental and linguistic evidence

Ⅳ. Developments in the methods used to study early population movements

Ⅴ. Indian migration from Canada to the U.S.A.

Ⅵ. Further genetic evidence relating to the three-wave theory

Ⅶ. Long-standing questions about prehistoric migration to America

Ⅷ. Conflicting views of the three-wave theory, based on non-genetic evidence

Ⅸ. Questions about the causes of prehistoric migration to America

Ⅹ. How analysis of blood-variants measures the closeness of the relationship between different populations

Example	Answer
Section G	VIII

【答案】

14. Ⅳ 15. Ⅶ 16. Ⅹ 17. Ⅰ 18. Ⅵ 19. Ⅱ

The Little Ice Age

A This book will provide a detailed examination of the Little Ice Age and other climatic shifts, but, before I embark on that, let me provide a historical context. We tend to think of climate - as opposed to weather - as something unchanging, yet humanity has been at the mercy of climate change for its entire existence, with at least eight glacial episodes in the past 730,000 years. Our ancestors adapted to the universal but irregular global warming since the end of the last great Ice Age, around 10,000 years ago, with dazzling opportunism. They developed strategies for surviving harsh drought cycles, decades of heavy rainfall or unaccustomed cold; adopted agriculture and stock-raising, which revolutionized human life; and founded the world's first pre-industrial civilizations in Egypt, Mesopotamia and the Americas. But the price of sudden climate change, in famine, disease and suffering, was often high.

14 **B** The Little Ice Age lasted from roughly 1300 until the middle of the nineteenth century. Only two centuries ago, Europe experienced a cycle of bitterly cold winters; mountain glaciers in the Swiss Alps were the lowest in-recorded memory, and pack ice surrounded Iceland for much of the year. The climatic events of the Little Ice Age did more than help shape the modern world. They are the deeply important context for the current unprecedented global warming. The Little Ice Age was far from a deep freeze, however; rather an irregular seesaw of rapid climatic shifts, few lasting more than a quarter-century, driven by complex and still little understood interactions between the atmosphere and the ocean. The seesaw brought cycles of intensely cold winters and easterly winds, then switched abruptly to years of heavy spring and early summer rains, mild winters, and frequent Atlantic storms, or to periods of droughts, light northeasterly winds, and summer heat waves.

C Reconstructing the climate changes of the past is extremely difficult, because systematic weather observations began only a few centuries ago, in Europe and North America. Records from India and tropical Africa are even more recent. For the time before records began, we have only 'proxy records' reconstructed largely from tree rings and ice cores, supplemented by a few incomplete written accounts. We now have hundreds of tree-ring records from throughout the northern hemisphere, and many from south of the equator, too, amplified with a growing body of temperature data from ice cores drilled in Antarctica, Greenland the Peruvian Andes, and other locations. We are close to knowledge of annual summer and winter temperature variations over much of the northern hemisphere going back 600 years.

15 **D** This book is a narrative history of climatic shifts during the past ten centuries, and some of the ways in which people in Europe adapted to them. Part One describes the Medieval Warm Period, roughly 900 t0 1200. During these three centuries, Norse voyagers from Northern Europe explored northern seas, settled Greenland, and visited North America. It was not a time of uniform warmth, for then, as always since the Great Ice Age, there were constant shifts in rainfall and temperature. Mean European temperatures were about the same as today, perhaps slightly cooler.

16 **E** It is known that the Little Ice Age cooling began in Greenland and the Arctic in about 1200. As the Arctic ice pack spread southward, Norse voyages to the west were rerouted into the open Atlantic, then ended altogether. Storminess increased in the North Atlantic and North Sea. Colder, much wetter weather descended on Europe between 1315 and 1319, when thousands perished in a continent-wide famine. By 1400, the weather had become decidedly more unpredictable and stormier, with sudden shifts and lower temperatures that culminated in the cold decades of the late sixteenth century. Fish were a vital commodity in growing towns and cities, where food supplies were a constant concern. Dried cod and herring were already the staples of the European fish trade, but changes in water temperatures forced fishing fleets to work further offshore. The Basques, Dutch, and English developed the first offshore fishing boats adapted to a colder and stormier Atlantic. A gradual agricultural revolution in northern Europe stemmed from concerns over food supplies at a time of rising populations. The revolution involved intensive commercial farming and the growing of animal fodder on land not previously used for crops. The increased productivity from farmland made some countries self-sufficient in grain and livestock and offered effective protection against famine.

17 **F** Global temperatures began to rise slowly after 1850, with the beginning of the Modern Warm Period. There was a vast migration from Europe by land-hungry farmers and others, to which the famine caused by the Irish potato blight contributed, to North America, Australia, New Zealand, and southern Africa. Millions of hectares of forest and woodland fell before the newcomers' axes between 1850 and -1890, as intensive European farming methods expanded across the world. The unprecedented land clearance released vast quantities of carbon dioxide into the atmosphere, triggering for the first time humanly caused global warming. Temperatures climbed more rapidly in the twentieth century as the use of fossil fuels proliferated and greenhouse gas levels continued to soar. The rise has been even steeper since the early 1980s. The Little Ice Age has given way to a new climatic regime, marked by prolonged and

steady warming. At the same time, extreme weather events like Category 5 hurricanes are becoming more frequent.

Question 14-17

Reading Passage 2 has seven paragraphs, ***A–F****.*
Choose the correct heading for paragraphs ***B*** *and* ***D–F*** *from the list of headings below.*

Write the correct number, Ⅰ – Ⅸ*, into boxes 14-17 on your answer sheet.*

List of Headings

Ⅰ. Predicting climatic changes
Ⅱ. The relevance of the Little Ice Age today
Ⅲ. How cities contribute to climate change Ⅳ. Human impact on the climate
Ⅴ. How past climatic conditions can be determined
Ⅵ. A growing need for weather record
Ⅶ. A study covering a thousand years
Ⅷ. People have always responded to climate change
Ⅸ. Enough food at last

Question 18-22

Complete the summary using the list of words, **A-I***, below.*

Write the correct letter, **A-I***, into boxes 1-5 on your answer sheet.*

Weather during the Little Ice Age

Documentation of past weather conditions is limited: our main sources of knowledge of conditions in the distant past are 18.....and 19..... We can deduce that the Little Ice Age was a time of 20....., rather than of consistent freezing. Within it there were some periods of very cold winters, others of 21.....and heavy rain, and yet others that saw 22.....with no rain at all.

A climatic shifts	**B** ice cores	**C** tree rings
D glaciers	**E** interactions	**F** weather observations
G heat waves	**H** storms	**I** written accounts

Question 23-26

Classify the following events as occurring during which period Write the correct letter, A. B or C in boxes 23-26 on your answer sheet.

A. Medieval Warm Period
B. Little Ice Age
C. Modem Warm Period

23. Many Europeans started farming abroad.
24. The cutting down of trees began to affect the climate.
25. Europeans discovered other lands.
26. Changes took place in fishing patterns.

【答案】
14. Ⅱ 15. Ⅶ 16. Ⅸ 17. Ⅳ

18. C 19. B 20. A 21. H 22. G

23. C 24. C 25. A 26. B

作业：

How Does the Biological Clock Tick?

A Our life span is restricted. Everyone accepts this as 'biologically' obvious. 'Nothing lives forever!' However, in this statement we think of artificially produced, technical objects, products which are subjected to natural wear and tear during use. This leads to the result that at some time or other the object stops working and is unusable ('death' in the biological sense). But are the wear and tear and loss of function of technical objects and the death of living organisms really similar or comparable?

27 **B** Our 'dead' products are 'static', closed systems. It is always the basic material which constitutes the object and which, in the natural course of things, is worn down and becomes 'older'. Aging in this case must occur according to the laws of physical chemistry and of thermodynamics. Although the same law holds for a living organism, the result of this law is not inexorable in the same way.At least as long as a biological system has the ability to renew itself it could actually become older without aging; an organism is an open, dynamic system through which new material continuously flows. Destruction of old material and formation of new material are thus in permanent dynamic equilibrium.The material of which the organism is formed changes continuously. Thus our bodies continuously exchange old substance for new, just like a spring which more or less maintains its form and movement, but in which the water molecules are always different.

28 **C** Thus aging and death should not be seen as inevitable, particularly as the organism possesses many mechanisms for repair. It is not, in principle, necessary for a biological system to age and die. Nevertheless, a restricted life span, aging, and then death are basic characteristics of life. The reason for this is easy to recognise: in nature, the existent organisms either adapt or are regularly replaced by new types. Because of changes in the genetic material (mutations) these have new characteristics and in the course of their individual lives they are tested for optimal or better adaptation to the environmental conditions. Immortality would disturb this system - it needs room for new and better life. This is the basic problem of evolution.

29 **D** Every organism has a life span which is highly characteristic. There are striking differences in life span between different species, but within one species the parameter is relatively constant. For example, the

average duration of human life has hardly changed in thousands of years. Although more and more people attain an advanced age as a result of developments in medical care and better nutrition, the characteristic upper limit for most remains 80 years. A further argument against the simple wear and tear theory is the observation that the time within which organisms age lies between a few days (even a few hours for unicellular organisms) and several thousand years, as with mammoth trees.

30 **E** If a life span is a genetically determined biological characteristic, it is logically necessary to propose the existence of an internal clock, which in some way measures and controls the aging process and which finally determines death as the last step in a fixed programme. Like the life span, the metabolic rate has for different organisms a fixed mathematical relationship to the body mass. In comparison to the life span this relationship is 'inverted': the larger the organism the lower its metabolic rate. Again this relationship is valid not only for birds, but also, similarly on average within the systematic unit, for all other organisms (plants, animals, unicellular organisms).

31 **F** Animals which behave 'frugally' with energy become particularly old, for example, crocodiles and tortoises. Parrots and birds of prey are often held chained up. Thus they are not able to 'experience life' and so they attain a high life span in captivity. Animals which save energy by hibernation or lethargy (e. g. bats or hedgehogs) live much longer than those which are always active. The metabolic rate of mice can be reduced by a very low consumption of food (hunger diet). They then may live twice as long as their well fed comrades. Women become distinctly (about 10 per cent) older than men. If you examine the metabolic rates of the two sexes you establish that the higher male metabolic rate roughly accounts for the lower male life span. That means that they live life 'energetically' - more intensively, but not for as long.

32 **G** It follows from the above that sparing use of energy reserves should tend to extend life. Extreme high performance sports may lead to optimal cardiovascular performance, but they quite certainly do not prolong life. Relaxation lowers metabolic rate, as does adequate sleep and in general and equable and balanced personality. Each of us can develop his or her own 'energy saving programme' with a little self-observation, critical self-control and, above all, logical consistency. Experience will show that to live in this way not only increases the life span but is also very healthy. This final aspect should not be forgotten.

Question 27-32

Reading Passage 3 has seven paragraphs, ***A–G****.*

*Choose the correct heading for paragraphs **B - G** from the list of headings below.*

Drag the correct number, Ⅰ–Ⅹ, into boxes 27 - 32 on your answer sheet.

List of Headings

Ⅰ. The biological clock
Ⅱ. Why dying is beneficial
Ⅲ. The ageing process of men and women
Ⅳ. Prolonging your life
Ⅴ. Limitations of life span
Ⅵ. Modes of development of different species
Ⅶ. A stable life span despite improvements
Ⅷ. Energy consumption
Ⅸ. Fundamental differences in ageing of objects and organisms
Ⅹ. Repair of genetic material

Question 33-36

Complete the notes below.

Choose ***NO MORE THAN TWO WORDS*** from the passage for each answer.

Write your answers in boxes 33-36 on your answer sheet.

Objects age in accordance with principles of 33.....
and of 34.....
Through mutations, organisms can 35..... better to the environment.
36..... would pose a serious problem for the theory of evolution.

Question 37-40

Do the following statements agree with the views of the writer in Reading Passage 3?
In boxes 37-40 on your answer sheet, write

TRUE if the statement agrees with the information
FALSE if the statement contradicts the information
NOT GIVEN if there is no information on this in the passage

37. The wear and tear theory applies to both artificial objects and biological systems.
38. In principle, it is possible for a biological system to become older without ageing.
39. Within seven years, about 90 per cent of a human body is replaced as new.
40. Conserving energy may help to extend a human's life.

【答案】

27. Ⅸ 28. Ⅱ 29. Ⅶ 30. Ⅰ 31. Ⅷ 32. Ⅳ

33. physical chemistry 34. thermodynamics 35. adapt 36. Immortality

37. FALSE 38. TRUE 39. NOT GIVEN 40. TRUE

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