第一大題 單選 (60%)

Section I:

Plant communities assemble themselves flexibly, and their particular structure depends on the specific history of the area. Ecologists use the term "succession" to refer to the changes that happen in plant communities and ecosystems over time. The first community in a succession is called a pioneer community, while the long-lived community at the end of succession is called a climax community. Pioneer and successional plant communities are said to change over periods from 1 to 500 years. These changes—in plant numbers and the mix of species—are cumulative. Climax communities themselves change but over periods of time greater than about 500 years.

An ecologist who studies a pond today may well find it relatively unchanged in a year's time. Individual fish may be replaced, but the number of fish will tend to be the same from one year to the next. We can say that the properties of an ecosystem are more stable than the individual organisms that compose the ecosystem.

1. The word "particular" in the passage is closest in meaning to
(1) Natural (2) Final (3) Specific (4) Complex

2. According to paragraph 1, which of the following is NOT true of climax communities?
(1) They occur at the end of a succession.
(2) They last longer than any other type of community.
(3) The numbers of plants in them and the mix of species do not change
(4) They remain stable for at least 500 years at a time.

3. According to paragraph 2, which of the following principles of ecosystems can be learned by studying a pond?
(1) Ecosystem properties change more slowly than individuals in the system.
(2) The stability of an ecosystem tends to change as individuals are replaced.
(3) Individual organisms are stable from one year to the next.
(4) A change in the members of an organism does not affect an ecosystem's properties

Section II:

It should be obvious that cetaceans—whales, porpoises, and dolphins-are mammals. They breathe through lungs, not through gills, and give birth to live young. Their streamlined bodies, the absence of hind legs, and the presence of a fluke[1] and blowhole[2] cannot disguise their affinities with land dwelling mammals. However, unlike the cases of sea otters and pinnipeds (seals, sea lions, and walruses, whose limbs are functional both on land and at sea), it is not easy to envision what the first whales looked like. Extinct but already fully marine cetaceans are known from the fossil record. ■How was the gap between a walking mammal and a swimming whale bridged? ■Missing until recently were fossils clearly intermediate, or transitional, between land mammals and cetaceans.

■Very exciting discoveries have finally allowed scientists to reconstruct the most likely origins of cetaceans. ■In 1979, a team looking for fossils in northern Pakistan found what proved to be the oldest fossil whale. The fossil was officially named Pakicetus in honor of the country where the discovery was made. Pakicetus was found embedded in rocks formed from river deposits that were 52 million years old. The river that formed these deposits was actually not far from an ancient ocean known as the Tethys Sea.

The fossil consists of a complete skull of an archaeocyte, an extinct group of ancestors of modern cetaceans. Although limited to a skull, the *Pakicetus* fossil provides precious details on the origins of cetaceans. The skull is cetacean-like but its jawbones lack the enlarged space that is filled with fat or oil and used for receiving underwater sound in modern whales. *Pakicetus* probably detected sound through the ear opening as in land mammals. The skull also lacks a blowhole, another cetacean adaptation for diving. Other features, however, show experts that *Pakicetus* is a transitional form between a group of extinct flesh-eating mammals, the mesonychids, and cetaceans. It has been suggested that *Pakicetus* fed on fish in shallow water and was not yet

見背面

adapted for life in the open ocean. It probably bred and gave birth on land.

Another major discovery was made in Egypt in 1989. Several skeletons of another early whale, Basilosaurus, were found in sediments left by the Tethys Sea and now exposed in the Sahara desert. This whale lived around 40 million years ago, 12 million years after *Pakicetus*. Many incomplete skeletons were found but they included, for the first time in an archaeocyte, a complete hind leg that features a foot with three tiny toes. Such legs would have been far too small to have supported the 50-foot-long *Basilosaurus* on land. *Basilosaurus* was undoubtedly a fully marine whale with possibly nonfunctional, or vestigial, hind legs.

An even more exciting find was reported in 1994, also from Pakistan. The now extinct whale *Ambulocetus natans* ("the walking whale that swam") lived in the Tethys Sea 49 million years ago. It lived around 3 million years after *Pakicetus* but 9 million before *Basilosaurus*. The fossil luckily includes a good portion of the hind legs. The legs were strong and ended in long feet very much like those of a modern pinniped. The legs were certainly functional both on land and at sea. The whale retained a tail and lacked a fluke, the major means of locomotion in modern cetaceans. The structure of the backbone shows, however, that *Ambulocetus* swam like modern whales by moving the rear portion of its body up and down, even though a fluke was missing. The large hind legs were used for propulsion in water. On land, where it probably bred and gave birth, *Ambulocetus* may have moved around very much like a modern sea lion. It was undoubtedly a whale that linked life on land with life at sea.

[1]Fluke: the two parts that constitute the large triangular tail of a whale
[2]Blowhole: a hole in the top of the head used for breathing

4. In paragraph 1, what does the author say about the presence of a blowhole in cetaceans?
(1) It clearly indicates that cetaceans are mammals.
(2) It cannot conceal the fact that cetaceans are mammals.
(3) It is the main difference between cetaceans and land-dwelling mammals.

5. Which of the following can be inferred from paragraph 1 about early sea otters?
(1) It is not difficult to imagine what they looked like
(2) There were great numbers of them.
(3) They lived in the sea only.

6. The word precious in the passage is closest in meaning to
(1) Exact (2) Scarce (3) Valuable (4) Initial

7. Pakicetus and modern cetaceans have similar
(1) Hearing structures (2) Adaptations for diving (3) Skull shapes

8. The word it in the passage refers to
(1) Pakicetus (2) Fish (3) Life (4) ocean

9. The word exposed in the passage is closest in meaning to
(1) Explained (2) Visible (3) Identified (4) Located

10. The hind leg of *Basilosaurus* was a significant find because it showed that Basilosaurus
(1) Lived later than *Ambulocetus natans*
(2) Lived at the same time as *Pakicetus*
(3) Was able to swim well
(4) Could not have walked on land

接次頁

11. It can be inferred that *Basilosaurus* bred and gave birth in which of the following locations
(1) On land
(2) Both on land and at sea
(3) In shallow water
(4) In a marine environment

12. Why does the author use the word luckily in mentioning that the *Ambulocetus natans* fossil included hind legs?
(1) Fossil legs of early whales are a rare find.
(2) The legs provided important information about the evolution of cetaceans.
(3) The discovery allowed scientists to reconstruct a complete skeleton of the whale.

13. Which of the sentences below best expresses the essential information in the highlighted sentence in the passage?
(1) Even though *Ambulocetus* swam by moving its body up and down, it did not have a backbone.
(2) The backbone of *Ambulocetus*, which allowed it to swim, provides evidence of its missing fluke.
(3) Although *Ambulocetus* had no fluke, its backbone structure shows that it swam like modern whales.

14. The word propulsion in the passage is closest in meaning to
(1)Staying afloat (2)Changing direction (3)Decreasing weight (4)Moving forward

15. Look at the four squares [■] that indicate where the following sentence can be added to the passage. **"This is a question that has puzzled scientists for ages."** Where would the sentence best fit?
(1) 1 (2) 2 (3) 3 (4) 4

第二大題 英翻中 (20%)
請將閱讀第一題的兩段內容翻成中文。

第三大題 中翻英 (20%)
此實驗以兩種珊瑚 *Isopora pallifera* 與 *Porites lobata* 進行不同程度酸化測試，想知道珊瑚身上微生物的多樣性指數 Shannon index 的差異。請根據下圖的結果，用英文描述此實驗結果。

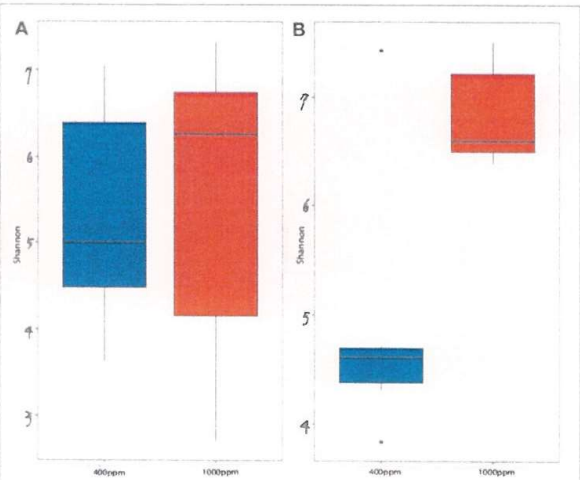

FIGURE 3 | Shannon diversity boxplot of the endolithic bacterial communities in the **(A)** *Isopora palifera* and **(B)** *Porites lobata* colonies under two pCO_2 treatments. Blue indicates the control (400 ppm pCO_2) and orange indicates the acidification treatment (1,000 ppm pCO_2).

試題隨卷繳回