tpo_15_passage_1

When it comes to physiology, the leatherback turtle is, in some ways, more like a reptilian whale than a turtle. It swims farther into the cold of the northern and southern oceans than any other sea turtle, and it deals with the chilly waters in a way unique among reptiles. A warm-blooded turtle may seem to be a contradiction in terms. Nonetheless, an adult leatherback can maintain a body temperature of between 25 and 26°C 77–79°F in seawater that is only 8°C 46.4°F. Accomplishing this feat requires adaptations both to generate heat in the turtle's body and to keep it from escaping into the surrounding waters. Leatherbacks apparently do not generate internal heat the way we do, or the way birds do, as a by-product of cellular metabolism. A leatherback may be able to pick up some body heat by basking at the surface; its dark, almost black body color may help it to absorb solar radiation. However, most of its internal heat comes from the action of its muscles. Leatherbacks keep their body heat in three different ways. The first, and simplest, is size. The bigger the animal is, the lower its surface-to-volume ratio; for every ounce of body mass, there is proportionately less surface through which heat can escape. An adult leatherback is twice the size of the biggest cheloniid sea turtles and will therefore take longer to cool off. Maintaining a high body temperature through sheer bulk is called gigantothermy. It works for elephants, for whales, and, perhaps, it worked for many of the larger dinosaurs. It apparently works, in a smaller way, for some other sea turtles. Large loggerhead and green turtles can maintain their body temperature at a degree or two above that of the surrounding water, and gigantothermy is probably the way they do it. Muscular activity helps, too, and an actively swimming green turtle may be 7°C 12.6°F warmer than the waters it swims through. Gigantothermy, though, would not be enough to keep a leatherback warm in cold northern waters. It is not enough for whales, which supplement it with a thick layer of insulating blubber fat. Leatherbacks do not have blubber, but they do have a reptilian equivalent: thick, oil-saturated skin, with a layer of fibrous, fatty tissue just beneath it. Insulation protects the leatherback everywhere but on its head and flippers. Because the flippers are comparatively thin and blade like, they are the one part of the leatherback that is likely to become chilled. There is not much that the turtle can do about this without compromising the aerodynamic shape of the flipper. The problem is that as blood flows through the turtle's flippers, it risks losing enough heat to lower the animal's central body temperature when it returns. The solution is to allow the flippers to cool down without drawing heat away from the rest of the turtle's body. The leatherback accomplishes this by arranging the blood vessels in the base of its flipper into a countercurrent exchange system. In a countercurrent exchange system, the blood vessels carrying cooled blood from the flippers run close enough to the blood vessels carrying warm blood from the body to pick up some heat from the warmer blood vessels;thus, the heat is transferred from the outgoing to the ingoing vessels before it reaches the flipper itself. This is the same arrangement found in an old-fashioned steam radiator, in which the coiled pipes pass heat back and forth as water courses through them. The leatherback is certainly not the only animal with such an arrangement; gulls have a countercurrent exchange in their legs. That is why a gull can stand on an ice floe without freezing. All this applies, of course, only to an adult leatherback. Hatchlings are simply too small to conserve body heat, even with insulation and countercurrent exchange systems. We do not know how old, or how large, a leatherback has to be before it can switch from a cold-blooded to a warm-blooded mode of life. Leatherbacks reach their immense size in a much shorter time than it takes other sea turtles to grow. Perhaps their rush to adulthood is driven by a simple need to keep warm.

question 1

The phrase “unique among” in the passage is closest in meaning to

A natural to

B different from all other

C quite common among

D familiar to

question 2

What can be inferred about whales from paragraph 1?

A They are considered by some to be reptiles.

B Their bodies are built in a way that helps them manage extremely cold temperatures.

C They are distantly related to leatherback turtles.

D They can swim farther than leatherback turtles.

question 3

Paragraph 2 mentions all of the following as true about the body heat of adult leatherback turtles EXCEPT

A Their muscles produce heat for maintaining body temperature.

B Their dark bodies help trap solar radiation.

C Their cellular metabolism produces heat as a by-product.

D Basking at the water’s surface helps them obtain heat.

question 4

The word "it" in paragraph 4 refers to

A the problem

B blood

C the turtle

D body temperature

question 5

According to paragraph 4, which of the following features enables the leatherback turtle to stay warm?

A An insulating layer of blubber

B A thick, oily skin covering fatty tissue

C The aerodynamic shape of its flippers

D A well-insulated head

question 6

Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

A In a turtle’ s countercurrent exchange system, outgoing vessels lie near enough to ingoing ones that heat can be exchanged from the former to the latter before reaching the turtle’ s flippers.

B Within the turtle’ s flippers, there is a countercurrent exchange system that allows colder blood vessels to absorb heat from nearby warmer blood vessels and then return warmed blood to the turtle’ s body.

C In a countercurrent exchange system, a turtle can pick up body heat from being close enough to other turtles, thus raising its blood temperature as it passes them.

D When a turtle places its flippers close to its body, it is able to use its countercurrent exchange system to transfer heat from the warmer blood vessels in its body to the cooler blood vessels in its flippers.

question 7

Why does the author mention "old-fashioned steam radiator" in the discussion of countercurrent exchange systems?

A To argue that a turtle’ s central heating system is not as highly evolved as that of other warm blooded animals

B To provide a useful comparison with which to illustrate how a countercurrent exchange system works

C To suggest that steam radiators were modeled after the sophisticated heating system of turtles

D To establish the importance of the movement of water in countercurrent exchange systems

question 8

According to paragraph 6, which of the following statements is most accurate about young leatherback turtles?

A They lack the countercurrent exchange systems that develop in adulthood.

B Their rate of growth is slower than that of other sea turtles.

C They lose heat easily even with insulation and countercurrent exchange systems.

D They switch between cold-blooded and warm-blooded modes throughout their hatchling stage.

question 9

Look at the four squares [ ] that indicate where the following sentence could be added to the passage.

When it comes to physiology, the leatherback turtle is, in some ways, more like a reptilian whale than a turtle. It swims farther into the cold of the northern and southern oceans than any other sea turtle, and it deals with the chilly waters in a way unique among reptiles. A warm-blooded turtle may seem to be a contradiction in terms. Nonetheless, an adult leatherback can maintain a body temperature of between 25 and 26°C 77–79°F in seawater that is only 8°C 46.4°F. Accomplishing this feat requires adaptations both to generate heat in the turtle's body and to keep it from escaping into the surrounding waters. Leatherbacks apparently do not generate internal heat the way we do, or the way birds do, as a by-product of cellular metabolism. A leatherback may be able to pick up some body heat by basking at the surface; its dark, almost black body color may help it to absorb solar radiation. However, most of its internal heat comes from the action of its muscles. Leatherbacks keep their body heat in three different ways. The first, and simplest, is size. The bigger the animal is, the lower its surface-to-volume ratio; for every ounce of body mass, there is proportionately less surface through which heat can escape. An adult leatherback is twice the size of the biggest cheloniid sea turtles and will therefore take longer to cool off. Maintaining a high body temperature through sheer bulk is called gigantothermy. [] It works for elephants, for whales, and, perhaps, it worked for many of the larger dinosaurs. [] It apparently works, in a smaller way, for some other sea turtles. [] Large loggerhead and green turtles can maintain their body temperature at a degree or two above that of the surrounding water, and gigantothermy is probably the way they do it. [] Muscular activity helps, too, and an actively swimming green turtle may be 7°C 12.6°F warmer than the waters it swims through. Gigantothermy, though, would not be enough to keep a leatherback warm in cold northern waters. It is not enough for whales, which supplement it with a thick layer of insulating blubber fat. Leatherbacks do not have blubber, but they do have a reptilian equivalent: thick, oil-saturated skin, with a layer of fibrous, fatty tissue just beneath it. Insulation protects the leatherback everywhere but on its head and flippers. Because the flippers are comparatively thin and blade like, they are the one part of the leatherback that is likely to become chilled. There is not much that the turtle can do about this without compromising the aerodynamic shape of the flipper. The problem is that as blood flows through the turtle's flippers, it risks losing enough heat to lower the animal's central body temperature when it returns. The solution is to allow the flippers to cool down without drawing heat away from the rest of the turtle's body. The leatherback accomplishes this by arranging the blood vessels in the base of its flipper into a countercurrent exchange system. In a countercurrent exchange system, the blood vessels carrying cooled blood from the flippers run close enough to the blood vessels carrying warm blood from the body to pick up some heat from the warmer blood vessels;thus, the heat is transferred from the outgoing to the ingoing vessels before it reaches the flipper itself. This is the same arrangement found in an old-fashioned steam radiator, in which the coiled pipes pass heat back and forth as water courses through them. The leatherback is certainly not the only animal with such an arrangement; gulls have a countercurrent exchange in their legs. That is why a gull can stand on an ice floe without freezing. All this applies, of course, only to an adult leatherback. Hatchlings are simply too small to conserve body heat, even with insulation and countercurrent exchange systems. We do not know how old, or how large, a leatherback has to be before it can switch from a cold-blooded to a warm-blooded mode of life. Leatherbacks reach their immense size in a much shorter time than it takes other sea turtles to grow. Perhaps their rush to adulthood is driven by a simple need to keep warm.

question 10

Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

A. The leatherback turtle is able to maintain body heat through sheer size.

B. Even though they swim into cold ocean waters, leatherbacks maintain their body heat in much the same way as sea turtles in warm southern oceans do.

C. Leatherbacks have an insulating layer that can be considered the reptilian version of blubber.

D. The leatherback turtle uses a countercurrent exchange system in order to keep the flippers from drawing heat away from the rest of the body.

E. Young leatherbacks often do not survive to adulthood because they are not able to switch from a cold-blooded way of life to a warm-blooded one quickly enough.

F. The shape of the leatherback turtle’ s flippers is especially important in maintaining heat in extremely cold northern waters.