



第6問 (配点 24)

A You are doing research on hibernating animals for your summer vacation homework. You found the following article. You are reading it and making a poster to present your findings.

About Frogs that Freeze During Hibernation

- (1) Frogs are part of a large animal group known as amphibians. There are over 4,000 species of amphibians, animals at home both on land and in water. Frogs hibernate — sleep, through the winter. When the outside temperature drops, the body temperature of frogs goes down and all body processes slow down. Certain frog species in extremely cold places can actually “freeze” for the winter and then defrost. This mechanism, in which living organisms freeze and then warm up and become operational again, offers potentially valuable medical information.
- (2) One frog that freezes is the wood frog found in Alaska. During winter, over 60% of the water content of their body freezes. Their hearts stop, as does their breathing. They appear dead, but, in actuality, they are just in an altered state. Their body temperature goes down to between  $-1^{\circ}\text{C}$  and  $-6^{\circ}\text{C}$ . The average January temperature in parts of Alaska where these frogs are found is  $-17^{\circ}\text{C}$ . Often, it gets even colder. The frogs bury themselves in mud and various plant life because this and fallen snow keep the ground temperature a bit warmer so they can survive.
- (3) People have long been fascinated with the idea of something freezing and then returning to normal. For the past half century, almost every food imaginable has been frozen and brought back to its original state, more or less. However, the science fiction idea of people with diseases being frozen and then brought back to life when a cure is found has yet to be realized. The key here is “original state.” No frog has died of illness or natural causes and then come back to life, but rather has started out healthy at the time of its frozen state and come back to life after the freeze ends.

- (4) When the wood frog hibernates, the water that surrounds its cells turns to ice. At the first contact with ice, there is a stress reaction in the body. This sends an enormous amount of sugar into the bloodstream. It is as much as 4,500 milligrams per deciliter, which would kill a human being. In conjunction with other substances in the frog’s cells, a kind of antifreeze is created. Also, certain proteins that prevent the frog’s cells from breaking are released into the blood.
- (5) When spring comes, the frog’s body reverses the process and it begins to thaw from the inside out. First, the brain and the heart warm up again. The warming process takes place over several hours. When the frog’s body temperature returns to normal, they just hop away as if they were never frozen. Wood frogs lay eggs in ponds that are formed from melted snow. Ponds sometimes dry up by summer, so the survival of their species depends on their laying eggs as soon as they recover from their frozen state.

About Frogs that Freeze During Hibernation

◆ About frogs

- amphibians, over 4,000 species
- some frogs in extremely cold places can “freeze” → 39

◆ Wood frogs in Alaska

- More than half of the water in their bodies becomes frozen.
- Their body temperature 40.
- They cover themselves in mud and plants.
- They look like they are no longer alive, even though they are.

◆ 41

the water around the cells becomes ice → sugar is sent into the bloodstream  
→ a kind of antifreeze is created → proteins are sent into the blood

When spring comes, 42.

問1 Choose the best option for  on your poster.

- ① frogs are able to move around freely in cold weather
- ② many frogs actually die from frost during the winter
- ③ most frogs that freeze never come back to life
- ④ some frogs that become frozen can return to normal

問2 Choose the best option for  on your poster.

- ① is higher than the Alaskan January temperature
- ② matches the Alaskan January temperature
- ③ often gets  $-17^{\circ}\text{C}$ , and sometimes even colder
- ④ remains almost same throughout the year

問3 Choose the best option for  on your poster.

- ① The amount of sugar in the bloodstream that will kill a frog
- ② The reasons the frog's body is able to freeze
- ③ The various reasons that the frog's cells sometimes break
- ④ The way the creation of antifreeze sometimes damages frogs

問4 Choose the best option for  on your poster.

- ① after the frog's temperatures go up, they have trouble moving
- ② the frog's heart function occurs at the end of the warming-up process
- ③ the process of warming up is actually a very quick one
- ④ wood frogs immediately lay their eggs

英語（リーディング）の試験問題は次に続く。