

第 6 問 (配点 24)

A You belong to an English discussion group. Each week, members read an article, create a summary, and make a challenging quiz question to share. For the next meeting, you read the following article.

Getting to Know Aquatic Species

The mysteries of the deep blue sea have fascinated ocean-watchers for millennia. Aquatic beings, however, cannot easily get to us. What if we go to them? Despite what you may expect, certain ocean animals will come right up to you. Dan McSweeney, a Hawaii-based underwater research photographer, tells a fascinating story. While he was studying whales underwater, one came charging at him. Whales are huge, so he was worried. The whale stopped, opened its mouth, and “passed” him some tuna. He accepted the gift. McSweeney believes that because of the air bubbles coming from his tank, the whale recognized him as a similar animal and offered the *sashimi*. Later, the whale came back, and McSweeney returned the food.

Friendly interactions with dolphins or whales are possible, but how about octopuses? Science fiction sometimes describes aliens as looking like octopuses, so this animal group “cephalopods,” which means “head-feet,” may be perceived as being distant from humans. Yet, if you learn more about them, you might be convinced there is the possibility of interaction. Octopuses have long tentacles (arms/legs) extending from soft round bodies. Besides touch and motion, each tentacle experiences smell and taste and has sucking disks, called *suckers*, that grab and manipulate things. Their eyes, like two independent cameras, can move 80° and focus on two different things at once. UC Berkeley researcher, Alexander Stubbs, confirms that while octopuses sense light and color differently from humans, they do recognize color

changes. These features might indicate that they are intelligent enough to interact with us. In fact, an article in *Everyday Mysteries* begins: “Question. Can an octopus get to know you? Answer. Yes.”

Octopuses are known to “return your gaze” when you look at them. They may even remember you. This notion was tested by Roland C. Anderson and his colleagues, who conducted experiments with two similar-looking people wearing the same uniforms. The friendly person, who had fed and socialized with them, got a completely different reaction from the cephalopods than the other person who had not.

When taken from their natural habitat, octopuses can be mischievous, so watch out. They can push the lids off their tanks, escape, and go for a walk. Scientists sometimes get surprise visits. A paper from the Naples Zoological Station, written in 1959, talks about trying to teach three octopuses to pull a lever down for food. Two of them, Albert and Bertram, cooperated with the experiment, but Charles, a clever cephalopod, refused to do so. He shot water at the scientists and ended the experiment by breaking the equipment.

If you are interested in seeing their natural behavior and interactions, getting into the sea and having them come to you might work better. They may even raise a tentacle to motion you over. Around 2007, Peter Godfrey-Smith, a philosophy professor teaching at Harvard University, was home on vacation in Sydney, Australia. Exploring in the ocean, he came across a giant cephalopod. Godfrey-Smith was so impressed by the behavior he witnessed that he started developing philosophy theories based on his observations. Determined to find out what humans could learn from cephalopods, Godfrey-Smith let them guide him. On one ocean trip, another cephalopod took Godfrey-Smith’s colleague by the hand on a 10-minute tour of the octopus’s home, “as if he were being led across the sea floor by a very small, eight-legged child!”

How can you get sea creatures to come to you if you don’t swim? The

Kahn family has solved this with “Coral World” in Eilat, Israel. The lowest floor of the building is actually constructed in the Red Sea, creating a “human display.” Rather than the sea-life performances at many aquariums, you find yourself in a “people tank,” where curious fish and sea creatures, swimming freely in the ocean, come to look at you. To make a good impression, you may want to wear nice clothes.

Your summary:

Getting to Know Aquatic Species

General information

The author mainly wants to say that 39 .

Human-octopus interaction

Anderson's experiment suggests octopuses can 40 .

The Naples Zoological Station experiment suggests octopuses can 41 .
Godfrey-Smith's story suggests octopuses can be friendly.

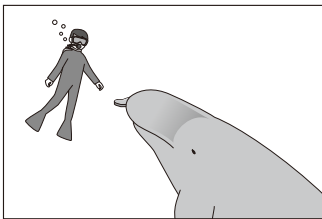
The Kahn family

Established Coral World with the idea of 42

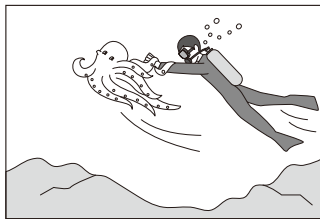
Your quiz question:

Which of the following does not represent a story or episode from the article?

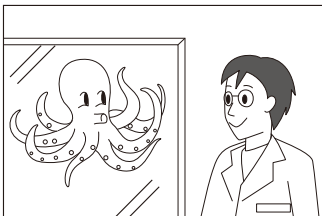
A



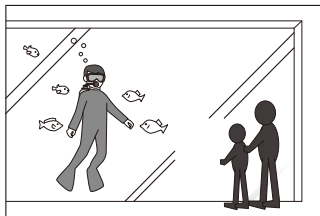
B



C



D



Answer 43

問 1 Choose the best option for 39 .

- ① a good place where people can interact with octopuses is the ocean
- ② eye contact is a key sign of friendship between different species
- ③ interactions with sea creatures can be started by either side
- ④ people should keep sea creatures at home to make friends with them

問 2 Choose the best options for 40 and 41 .

- ① be a good source for creating philosophical theories
- ② be afraid of swimmers when they get close to their home
- ③ be uncooperative with humans in a laboratory setting
- ④ compete with other octopuses if they have chances to get treats
- ⑤ recognize that someone they have met before is kind
- ⑥ touch, smell, taste, and sense light and color like humans

問 3 Choose the best option for 42 .

- ① attracting more people with a unique aquarium
- ② creating a convenient place to swim with sea life
- ③ raising more intelligent and cooperative octopuses
- ④ reversing the roles of people and sea creatures

問 4 The answer to your quiz question is 43 .

- ① A
- ② B
- ③ C
- ④ D

B You are preparing a poster for an in-school presentation on a scientific discovery, using the following article.

As you are reading this, you probably have a pencil in your hand. In the center of every pencil is something called “lead.” This dark gray material is not actually lead (Pb), but a different substance, graphite. Graphite has been a major area of research for many years. It is made up of thin layers of carbon that can be easily separated. Indeed, it is this ease of separation that enables the pencil to write. As the pencil rubs against the paper, thin layers of carbon are pulled off the pencil lead and left on the paper as lines or writing.

In 2004, two scientists, Andre Geim and Konstantin Novoselov, were investigating graphite at the University of Manchester, in the UK. They were trying to see if they could obtain a very thin slice of graphite to study. Their goal was to get a slice of carbon which was between 10 and 100 layers thick. Even though their university laboratory had the latest scientific equipment, they made their incredible breakthrough — for what was later to become a Nobel Prize-winning discovery — with only a cheap roll of sticky tape.

In a BBC News interview, Professor Geim described their technique. He said that the first step was to put sticky tape on a piece of graphite. Then, when the tape is pulled off, a flake of graphite will come off on the tape. Next, fold the tape in half, sticking the flake onto the other side of the tape. Then pull the tape apart to split the flake. You now have two flakes, roughly half as thick as before. Fold the tape together once more in a slightly different position to avoid having the flakes touch each other. Pull it apart again, and you will now have four thinner flakes than before. Repeat this procedure 10 or 20 times, and you’re left with many very thin flakes attached to your tape. Finally, you dissolve the tape using chemicals so everything goes into a solution.

Geim and Novoselov then looked at the solution, and were surprised to see

that the thin flakes were flat and not rolled up — and even more surprised that the flakes were as thin as only 10 layers of graphite. As graphite conducts electricity, it was only a matter of weeks before they were studying whether these thin sheets could be used in computer chips. By 2005, they had succeeded in separating a single layer of graphite. As this does not exist naturally, this new material was given a new name: graphene. Graphene is only one atom thick, and perhaps the thinnest material in the universe. It is one of the few two-dimensional (2D) materials known, and forms a six-sided, honeycomb-patterned structure. In addition, it is possibly the lightest and strongest substance known on earth. It is also excellent at carrying electricity. In fact, at laboratory temperatures (20-25°C), graphene conducts electricity faster than any known substance. This has led to manufacturers investing in further research because graphene-based batteries could last three times longer and be charged five times faster than lithium-ion batteries.

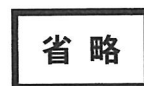
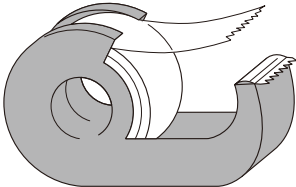


Figure 1. Structure of Graphene

Graphene has been called a super-material because of its amazing properties. It is 1,000 times lighter than paper and close to being totally transparent. It allows 98% of light to pass through it while at the same time it is so dense that even one molecule of helium gas cannot pass through it. It can also convert light into electricity. It is 200 times stronger than steel by weight: So strong in fact, that if you could make a 1 m^2 sheet of graphene, it would weigh less than a human hair and be strong enough to hold the weight of a cat. Quite simply, this material found in pencil lead has the potential to revolutionize the development of computer chips, rechargeable batteries, and strong, light-weight materials.

Your presentation poster draft:

Graphene	
Basic information	44
Graphene. . . A. is a 2D material. B. is a separated layer of graphite. C. is an extremely thin sheet of metal. D. is not a naturally occurring substance. E. looks like a sheet of wire mesh. F. was isolated without advanced equipment.	
How Geim and Novoselov separated graphite (5 steps)	
Step 1. Press sticky tape on graphite and remove. Step 2. } Step 3. } Step 4. }	45 
Step 5. Dissolve tape in a chemical solution and collect the flakes.	
The properties of graphene	
46 47	
Future use	
48	

問 1 You are checking your poster. You spotted an error in the basic information section. Which of the following should you remove?

44

- ① A
- ② B
- ③ C
- ④ D
- ⑤ E
- ⑥ F

問 2 You are going to summarize the five-step process used to separate layers of graphite. Choose the best combination of steps to complete the process.

45

- A. Do this process over and over again.
- B. Fold tape in two again so another part of the tape touches the graphite.
- C. Fold tape in two and pull it apart.
- D. Place tape on the thinner flakes and press down.
- E. Pull a flake of graphite off some sticky tape.

- ① C → B → A
- ② C → E → D
- ③ D → C → B
- ④ D → E → A
- ⑤ E → C → A
- ⑥ E → C → D

問 3 From the list below, select the two which best describe graphene's properties. (The order does not matter.) 46 • 47

- ① At average room temperature, it is the world's most efficient material for carrying electricity.
- ② Gram for gram, graphene is stronger and more resistant to electricity.
- ③ Graphene weighs slightly more than graphite per cm^2 .
- ④ It allows almost all light to pass through its structure.
- ⑤ Its six-sided honeycomb structure allows gas particles to pass from one side to another.

問 4 From this passage, which of the following might graphene be used for in the future? 48

- ① A material for filtering small gas molecules from large ones
- ② Developing light-sensitive chips
- ③ Electricity resistant materials
- ④ Increasing the weight and strength of batteries

問 5 From this passage, we can infer that the writer 49 .

- ① believed that many great Nobel Prize-winning discoveries have been made with low-cost equipment
- ② knew about the potential of graphene to reduce the production costs and recharging times of rechargeable batteries
- ③ was impressed by the fact that graphene and all its properties had lain hidden in every pencil mark until being revealed by Geim and Novoselov
- ④ was surprised at how long it took for Geim and Novoselov to realize the potential of using thin sheets of graphene in computer chips