

英 語

問題冊子 2

注 意

「問題冊子 2」に印刷されている問題は、 から までで、2 ページから 17 ページまであります。

問題は次のページからです。

2 次の対話の文章を読んで、あとの各問に答えなさい。

(* 印の付いている単語・語句には、本文のあとに〔注〕がある。)

*During spring break, two Japanese high school students, Saya and Daisuke are visiting universities in the US. One day they visit a university and meet a university student, Grace. She is going to show them her *laboratory. They have just met in front of her laboratory.*

Grace: Hi! Thank you for coming to our university. How are you today?

Saya: I'm so happy to be here!

Daisuke: Not so bad.

Grace: Great! Today, I'll show you my laboratory. Come in!

Daisuke: Wow! There are so many desks and machines here.

Saya: This is so cool!

Grace: I'm glad you think so.

Saya: I've heard you study *engineering here.

Grace: Yes. Are you interested in engineering?

Saya: Yes! I would love to be an engineer and make robots in the future.

Grace: I study engineering, but I don't make robots. I hope you're not disappointed!

Saya: I'm not. That's still interesting!

Daisuke: So what kind of engineering are you studying here?

Grace: I study *materials engineering. I learn how to develop or *utilize materials in this laboratory.

Saya: Materials? You study materials like plastic, wood...?

Grace: No. In this laboratory, we are studying materials *inspired by living things in the ocean.

Daisuke: (a)

Grace: Actually, it's not! We already have many products using such materials around us. For example, there are many products using materials inspired by shark skin like planes, ships and *swimsuits.

Daisuke: I've heard about the swimsuits before. My friend in my swimming club told me about them. We can swim very fast when we wear them.

Saya: I don't think that's possible.

Daisuke: Yes, it is.

Saya: How?

Daisuke: Ah... maybe shark skin gives swimmers the power to do that.

Saya: (b) Do you, Grace?

Grace: Maybe this can help. Look at the picture on my computer.

Saya: Wow! There are so many tiny things in the picture. What are they?

Grace: They're shark *scales. When we look at shark skin through an *electron microscope, it looks like this.

Saya: I see.

Grace: Look at these scales carefully. You can see *grooves on each scale. These grooves help reduce water *resistance when sharks swim in the ocean.

Daisuke: So they can swim fast! Swimsuits inspired by shark skin were inspired by shark scales.

Saya: Wow, that makes sense. Now I understand why we can swim fast when we wear them.

Daisuke: I want to wear one in a swimming competition.

Grace: Ah.... You may be disappointed. Now rules about swimsuits are stricter and they are banned in most competitions.

Daisuke: Oh no!

Grace: Sorry, Daisuke. But many companies are still interested in shark skin for other products.

Daisuke:

Grace: The *surface of shark skin is always clean thanks to the grooves on the scales.

Saya: What does that mean?

Grace: I mean *barnacles don't *stick to shark skin because of the grooves on the scales, though they stick to living things in the ocean such as whales. So now *coatings inspired by shark skin are used for ships.

Saya: I see. So you're studying sharks.

Grace: I like sharks, but I'm actually studying something else. *Shellfish!

Saya: Shellfish? I can't imagine anything inspired by shellfish.

Grace: We have a lot of things to learn from shellfish! Recently, researchers in Japan and other countries have invented *adhesives inspired by *mussels.

Daisuke: Mussels! How did they invent mussel adhesives? I can't imagine adhesives inspired by them.

Grace: Mussels have a special *protein and they can stick to rocks and other things by using it. The researchers invented adhesives inspired by the protein.

Daisuke: I see.

Grace: Mussel adhesives are different from other kinds of adhesives.

Saya:

Grace: We usually use adhesives in dry conditions. We can't use them in water because they won't stick when they are wet. But mussel adhesives stick in water!

Daisuke: That's amazing!

Grace: Yes! And now researchers are trying to invent medical adhesives inspired by mussels.

Daisuke: Why are they trying to do that?

Grace: Now, one of the problems during operations in hospitals is that we cannot use adhesives in wet conditions, but mussel adhesives can be used in such conditions.

Daisuke: Wow! I never realized that learning about sharks and shellfish was so useful for us.

Grace: Not only that, but doing this is good for the environment, too.

Daisuke: Is it?

Grace: Yes. Do you remember the coatings inspired by shark skin for ships?

Saya: Yes, you talked about them before.

Grace: They are also eco-friendly. People used *organotin compounds for ship coatings before, but they were bad for the ocean. So now, we use ship coatings inspired by shark skin and other eco-friendly ship coatings because they don't include organotin compounds.

Daisuke: Oh! When we learn from living things, we can make things that are good for humans and the environment.

Saya: When I become an engineer, I want to learn from living things, too!

Grace: Great, Saya! There's another important thing to remember.

Saya:

Grace: Working together is important when we invent things. When I started to study materials engineering, I realized that I should know not only about engineering but also about living things in the ocean, environmental issues, and many other things.

Saya: Wow. I didn't know that (2) 【ア things イ become ウ to 工 many オ to be 力 had キ done ク so】 an engineer.

Grace: Remember, you don't need to work alone. You can ask other engineers and researchers to help you. They may also ask you for help. When people in different fields work together and help each other, it becomes quicker and easier to think of new *inventions.

Daisuke: Oh! So working together is really important!

Saya: When I create robots, I'll ask other researchers and engineers for help. Maybe I can create robots inspired by animals! I want to learn how they move, and use their abilities for my robots when I become an engineer. It's going to be so exciting!

Daisuke: Maybe I can learn how to swim fast from sharks or other fish!

Saya: Then you'll be a great swimmer.

Grace: I think so too! I'm glad you two are interested in materials engineering. I hope you enjoyed today's visit. Now, it's time for lunch. If you like, why don't we go to the university cafeteria? They have a delicious shellfish pizza.

Daisuke: Sounds good! I want to go.

Saya: Yes! Let's go!

〔注〕	laboratory 研究室	engineering 工学	material 材料
	utilize 利用する	inspire 着想を与える	swimsuit 水着
	scale うろこ	electron microscope 電子顕微鏡	
	groove 溝	resistance 抵抗	surface 表面
	barnacle フジツボなど固着性甲殻類の総称		stick くっつく
	coating コーティング	shellfish 貝	adhesive 接着剤
	mussel ムラサキイガイ	protein タンパク質	
	organotin compound 有機スズ化合物		invention 発明

〔問1〕 本文の流れに合うように、 ~ の中に、英文を入れるとき、最も適切なものを次の中からそれぞれ一つずつ選びなさい。ただし、同じものは二度使えません。

- ア What is it?
- イ Why are they interested in it?
- ウ That sounds difficult.
- エ How are they different?
- オ I don't understand.

〔問2〕 ⁽²⁾【ア things イ become ウ to エ many オ to be カ had キ done ク so】とあるが、本文の流れに合うように、【】内の単語・語句を正しく並べかえたとき、1番目と4番目と7番目にくるものは、それぞれア〜クの中ではどれか。

〔問3〕 次の(A), (B)について、本文の内容に合っている英文を全て選ぶとき、最も適切なものは、それぞれ下のア～コの中ではどれか。

(A)

- ① Saya found out that Grace did not make robots, and she was so disappointed that she could not ask any more questions after that.
- ② Grace studies materials engineering and learns how to utilize materials such as plastic or wood.
- ③ Before Daisuke met Grace at her university, one of his club members told him about swimsuits inspired by shark skin.
- ④ Sharks have grooves on their scales and always keep their skin clean, so barnacles stick to sharks.

ア	①	イ	②	ウ	③
エ	④	オ	① ②	カ	① ③
キ	① ④	ク	② ③	ケ	② ④
コ	③ ④				

(B)

- ① Adhesives inspired by mussels are special because only researchers in Japan know how to invent them.
- ② Researchers are now trying to invent medical adhesives inspired by mussels because mussel adhesives can be used in wet conditions.
- ③ Ship coatings inspired by shark skin are good for the environment because they include organotin compounds.
- ④ Saya wants to learn from animals to utilize their abilities when she becomes an engineer and makes robots.

ア	①	イ	②	ウ	③
エ	④	オ	① ②	カ	① ③
キ	① ④	ク	② ③	ケ	② ④
コ	③ ④				

〔問4〕 次の文章は、Daisuke が書いた日記の文章である。対話文の内容に一致するように、(a)～(d)の中に、それぞれ適切な**英語1語**を入れなさい。

Today, Saya and I visited a university in the US and met Grace. She studies how to develop materials inspired by living things in the ocean. As an (a) of products made from such materials, we talked about swimsuits inspired by shark skin. Then, Grace explained why we could swim fast by (b) the swimsuits. She is now studying materials inspired by shellfish and told us about adhesives inspired by mussels. I realized that (c) from living things is good because we can invent useful and eco-friendly things by doing so. Grace told us that working together and helping each other is important because we can think of new inventions more quickly and (d). Saya and I enjoyed today's visit very much.

3 次の文章を読んで、あとの各問に答えなさい。

(* 印の付いている単語・語句には、本文のあとに〔注〕がある。)

When you were small, what kind of activity was your favorite? Some of you may answer drawing pictures or reading books, and some of you may answer folding paper: origami. Origami is the traditional Japanese art of folding paper. Even small children can create plants, animals, and various other things by just folding a piece of paper. (1) However, origami is more than this. It has the power to *innovate technology. Some great examples of this are shown in the field of space science.

You may wonder how origami is connected to space science. Have you ever *unfolded the origami that you created? The beautiful *geometric lines on the paper may be surprising to you. In the past, some people noticed that those lines could be helpful in math and science. In the 1970s, a Japanese scientist studied them to help create rockets and planes, and invented a famous *folding pattern: the Miura-ori. The Miura-ori (2) 【quickly open / to / even a / allows / large / you / and close】 piece of paper by just pulling and pushing on its *diagonal corners. In Japan, the folding pattern is found in various products such as paper pocket maps that are opened and closed easily.

The Miura-ori was a key to developing space science in Japan. The folding pattern was used for the *solar panels of the Space Flyer Unit (SFU), Japan's *satellite for space experiments and *observations. The SFU was developed to perform many missions, and one important mission was to find out how the solar panels could work well in space. The solar panels needed to have a large *surface area to get a lot of energy from sunlight. ア At the same time, however, they needed to become small enough to keep in the SFU for delivery. イ You may think scientists and engineers needed to make the impossible possible. ウ Thanks to the folding pattern, the solar panels could be folded and unfolded, and this problem was solved. エ In 1995, the SFU was *launched and the use of the solar panels in space was successful. オ

One example of space science using another folding pattern is the space yacht developed by *JAXA: (4) IKAROS. Please think of yachts with *sails on Earth. How do they move? They are moved by the wind on their sails. Then how about the space yacht? There is no air in space, but IKAROS is moved by the *pressure from sunlight on a large, square, and thin *membrane called a solar sail. IKAROS also has thin *solar cells on its sail. Like the solar panels of the SFU, a (5)-a sail is effective to get energy from sunlight, but a (5)-b one is also convenient when IKAROS is leaving Earth. To make this possible, a special folding pattern was used for the solar sail. The IKAROS project leader said that there were various main missions of the project and the most difficult mission was to unfold the large, square, and thin solar sail in space. While the project team members were preparing to launch IKAROS, they tried various folding patterns and then decided on the best one. Thanks to these efforts and many others, IKAROS was launched in 2010 and the main missions were all successful. IKAROS became the first space yacht that realized the use of a solar sail in space.

Origami is getting a lot of attention not only in Japan but also around the world. *NASA invented a *prototype of a starshade. Some people use a sunshade or a *parasol, especially during summer. As the name shows, a sunshade provides *shade from sunlight. So a starshade provides shade from starlight, and the shape of the starshade is actually similar to a parasol. However, why is shade from starlight necessary in space? Planets move around stars in space, but it is not possible to see the planets well because of the strong starlight from the stars. One of the ways to solve this problem is to use a starshade. A space *telescope will carry the folded starshade. The starshade will unfold, and at the same time fly to the spot between the space telescope and a star, and *block the starlight from the star. If this plan is realized, it may be possible to get a clear look at and study for signs of life there. The starshade uses a folding pattern called the flasher pattern. It is folded into a small size and unfolded into a huge one. The starshade is still a prototype and only one example in the field of space science, so its future may change greatly.

The power of origami is not just for space science. It has been innovating other technology such as medical tools and robots. Scientists and engineers have found ideas to innovate technology from origami. New ideas may come from things you do or use in your daily life. So please take a look at the things around you. They may lead you to great discoveries.

〔注〕	innovate 革新する	unfold 開く	geometric 幾何学の
	folding pattern 折り方	diagonal 対角の	solar panel 太陽光パネル
	satellite 人工衛星	observation 観測	surface area 表面積
	launch 打ち上げる	JAXA 宇宙航空研究開発機構	
	sail 帆	pressure 圧力	membrane 膜
	solar cell 太陽電池	NASA 米国航空宇宙局	prototype 試作機
	parasol 日傘	shade 陰	telescope 望遠鏡
	block 遮断する		

〔問1〕 本文の流れに合うように、 の中に英文を入れたとき、最も適切なものは、次のア～エの中ではどれか。

- ア So most of you may think that it is simple.
- イ So most of you may think that it is difficult.
- ウ So most of you may not think that it is for children.
- エ So most of you may not think that it is for adults.

〔問6〕 本文の流れに合うように、(6)の中に入る**同じ段落中の適切な英語 1 語**を書きなさい。

〔問7〕 次の(A), (B)について、本文の内容に合っている英文を全て選ぶとき、最も適切なものは、それぞれ下のア～コの中ではどれか。

(A)

- ① Origami is the modern art of folding paper in Japan, and small children can create things like plants and animals with it.
- ② By studying geometric lines to help create rockets and planes, a Japanese scientist invented a famous folding pattern that is used in various products.
- ③ The SFU had a lot of missions, and an important one was to find its solar panels in space.
- ④ The solar panels of the SFU used a different folding pattern from the solar sail of IKAROS.

ア	①	イ	②	ウ	③
エ	④	オ	① ②	カ	① ③
キ	① ④	ク	② ③	ケ	② ④
コ	③ ④				

(B)

- ① JAXA developed IKAROS, and it became the first space yacht that was able to use starlight on its sail.
- ② NASA invented a prototype of a starshade that provides shade from starlight, and its shape is like a parasol.
- ③ A space telescope will fly to the spot between the starshade and a star, and block the starlight from the star.
- ④ There are many great examples using ideas from origami in the field of space science such as the SFU, IKAROS, the sunshade, and the starshade.

ア	①	イ	②	ウ	③
エ	④	オ	① ②	カ	① ③
キ	① ④	ク	② ③	ケ	② ④
コ	③ ④				

4 次の文章を読んで、あとの各問に答えなさい。

(* 印の付いている単語・語句には、本文のあとに〔注〕がある。)

When you think of Japanese culture, you may imagine things like Japanese food, gardens, shrines, temples, and anime. However, one of the things that tourists from different countries are surprised to see when they visit Japan is something you often see in your daily life: vending machines. There are a lot of vending machines in Japan, and they sell a variety of things. In reality, now the number of vending machines in Japan is the second largest in the world after the US. However, if you think of the population and area of both countries, you have more chances to see vending machines in Japan than in the US. You may think that the vending machine was invented in Japan. Actually, (1) .

You will probably be surprised to learn that the first vending machine in the world was invented in ancient Egypt. An engineer invented a *device that sold *holy water in temples. At that time, people washed their face and hands with holy water before entering temples. When a coin was put into the device, it landed on a plate that was connected to a *lever. The *weight of the coin pulled the lever, and then a *valve opened and holy water came out. When the coin fell off the (2)-a , the (2)-b went back to its original spot, and the (2)-c closed. Thanks to this device, people could not take more than the amount of holy water that they bought, and almost the same amount was provided to each person. You now know the first vending machine was created a long time ago, so you may think that since then vending machines have developed over the centuries little by little. However, more modern vending machines were not invented for a long time.

*Commercial vending machines first appeared in the late 19th century in the UK. In 1883, vending machines selling stationery such as postcards, paper, and envelopes were *installed at train stations in London. People really liked these machines because they could use them even on Sundays, and they met people's need to communicate with others through writing. In 1888, vending machines selling *chewing gum were introduced at train stations in New York, in the US. By the early 1890s, vending machines were also installed in Germany and sold things like chocolate and chewing gum. In 1897, a company in the US put pictures on chewing gum vending machines to make their products more attractive and draw customers' attention.

Another type of vending machine was introduced in Germany at the end of the 19th century. In 1895, a *coin-operated fast food restaurant called an "automat" appeared. In this restaurant, simple foods and drinks were served through vending machines and there were usually only a few staff members. ア In 1902, an automat opened in a city called *Philadelphia on *the East Coast. イ A lot of vending machines were installed there, and customers could buy foods such as sandwiches, pies, and soups by putting coins in the machines. ウ It was a great *success, so its managers planned to open another automat in a bigger and busier city. In 1912, they met their

goal, and a new automat opened in New York. 工 During their most popular period, in the 1950s, automats were serving about 750,000 customers a day. 才 However, in the 1960s, fast food chains such as hamburger chains became popular. So, many automats started to close, and finally the last one in New York disappeared in 1991.

You probably see a lot of ⁽⁴⁾drink vending machines in your daily life, so let's talk about their history now. The world's first drink vending machine was invented in France in 1891. In 1926, soft drink vending machines appeared in amusement parks in New York. At that time, bottles were not used, and instead drinks were put into paper cups. About 10 years later, in 1937, a company in the US created a new vending machine selling *bottled drinks. In Japan, the first soft drink vending machine was introduced in 1957 and it sold orange juice for 10 yen. For the first few years it was a huge success, but around that time prices rose quickly, so the same orange juice could not be provided for the same price anymore. In 1965, the number of vending machines increased a lot, but there was a problem. The vending machines accepted only coins not paper money. Also, 100-yen coins used at that time were very expensive to make, so they did not *circulate among people. To solve this problem the Japanese government started to make a new 100-yen coin in 1967. This coin was less expensive to make and also very convenient because with this coin people could easily buy drinks from vending machines. In 1976, vending machines that could serve both hot and cold coffee were invented, so people could enjoy hot coffee even on a cold day almost anywhere in Japan. Because of all of these changes, buying drinks from vending machines has become more (5) in Japan. Around that time vending machines selling train tickets were also installed, and as a result the number of vending machines in Japan increased quickly in the 1970s and 1980s.

In the 21st century, like other technologies, vending machines developed. One good example is that customers could choose to pay with *cash or *credit card. Around 2006, vending machines that could accept credit cards became *available in the US. Cash is not necessary anymore, so more expensive products are sold now. For example, in Singapore there is a huge vending machine about 45 meters high. In this machine about 60 expensive cars are sold. As you do with other vending machines, if you ⁽⁶⁾【ア pushing イ as ウ do エ a オ as simple カ something キ button】, the selected product will be carried down to the ground in about two minutes. Vending machines are still getting smarter and smarter, so these days various kinds of IC cards and even smartphones can be used to buy things from many of the vending machines available in the world.

As we discussed above, vending machines have developed in a variety of ways. With some vending machines, *IoT technology is used, so today the record of your drink *purchases, for example, can be kept on the Internet. If this system is used across Japan in the future, this record may be used for selling drinks. When you buy a drink from a vending machine, you may be asked a question like, “Would you like the one you usually get?”

〔注〕 device 装置	holy water 聖水	lever レバー
weight 重み	valve バルブ	commercial 商業用の
install 設置する	chewing gum チューインガム	
coin-operated 硬貨で稼動する		Philadelphia フィラデルフィア
the East Coast 東海岸	success 成功	bottled 瓶詰めされた
circulate 流通する	cash 現金	credit card クレジットカード
available 利用できる	IoT インターネット化	purchase 購入

〔問1〕 本文の流れに合うように、 の中に英語を入れたとき、最も適切なものは、次のア～エの中ではどれか。

- ア this will be true
- イ this will not be true
- ウ this is true
- エ this is not true

〔問2〕 本文の流れに合うように、, , の中に単語を入れたとき、その組み合わせとして最も適切なものは、次のア～カの中ではどれか。

	<input type="text" value="(2)-a"/>	<input type="text" value="(2)-b"/>	<input type="text" value="(2)-c"/>
ア	lever	plate	valve
イ	lever	valve	plate
ウ	plate	lever	valve
エ	plate	valve	lever
オ	valve	plate	lever
カ	valve	lever	plate

〔問3〕 次の英文は、 ～ のいずれかに入る。この英文を入れるのに最も適切な場所を選びなさい。

This new business style actually became a big hit in the US.

〔問4〕 ⁽⁴⁾ drink vending machines について、それに関連した内容を正しく表した英文の組み合わせとして最も適切なものは、下のア～コの中ではどれか。

- ① The first drink vending machine in the world was created in the US.
- ② In 1926, drinks were provided in paper cups in amusement parks in New York.
- ③ In Japan, a 100-yen coin was necessary to buy orange juice in 1957.
- ④ The new 100-yen coin was made by the Japanese government in 1967.
- ⑤ In Japan, hot coffee was sold in vending machines before 1976.

ア	① ②	イ	① ③	ウ	① ④
エ	① ⑤	オ	② ③	カ	② ④
キ	② ⑤	ク	③ ④	ケ	③ ⑤
コ	④ ⑤				

〔問5〕 本文の流れに合うように、 の中に入る同じ段落中の適切な英語1語を書きなさい。

〔問6〕 ⁽⁶⁾ 【ア pushing イ as ウ do エ a オ as simple カ something キ button】 とあるが、本文の流れに合うように、【】内の単語・語句を正しく並べかえたとき、1番目と3番目と5番目にくるものは、それぞれア～キの中ではどれか。

[問7] 次の(A), (B)について、本文の内容に合っている英文を全て選ぶとき、最も適切なものは、それぞれ下のア～コの中ではどれか。

(A)

- ① Anime is one of the things tourists from different countries are surprised to see when they visit Japan.
- ② These days, there are more vending machines in the US than in any other country in the world.
- ③ When people visited temples in ancient Egypt, they bought holy water to wash their arms and legs before entering them.
- ④ With the world's first vending machine, exactly the same amount of holy water was provided to each person.

ア	①	イ	②	ウ	③
エ	④	オ	① ②	カ	① ③
キ	① ④	ク	② ③	ケ	② ④
コ	③ ④				

(B)

- ① In London, in the late 19th century, vending machines selling stationery such as paper were installed at train stations, and people could use them even on Sundays.
- ② In the US, in 1897, to make products sold through vending machines more attractive and draw customers' attention, pictures were put on chocolate vending machines.
- ③ Today, if you have enough electronic money on your IC cards or smartphones, real money is not necessary to buy things from any vending machines in the world.
- ④ In the future, when you buy a drink from a vending machine, it may ask a question like, "Would you like the one you usually get?" because of the record of your purchases.

ア	①	イ	②	ウ	③
エ	④	オ	① ②	カ	① ③
キ	① ④	ク	② ③	ケ	② ④
コ	③ ④				

〔問8〕 下の英文を読み、それに対して、**40 語以上 50 語以内**の英語の文章を**1つの段落**にまとめて書きなさい。「.」「,」「!」「?」などは、語数に含めません。これらの符号は、解答用紙の下線部と下線部の間に入れなさい。

Choose a product or food that is a unique part of Japanese daily life and culture. Explain what it is and why it is unique. Write the answer to someone who does not know much about the product or food. You cannot write about either vending machines or origami.

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