

第 1 問から第 4 問では、問題文の中の [] 内の数字はマークシートの間番号を示している。該当する問番号の解答記入欄に答をマークしなさい。

第 1 問 次の問 1 ～ 6 の空所 [1] ～ [6] に入れるのに最も適切なものを (1) ～ (4) から 1 つ選び、その番号をマークしなさい。

問 1. It is pure [1] that she will ever come back to me.

- (1) faculty (2) fantasy (3) favor (4) flaw

問 2. New Zealand is an island nation [2] the southeast coast of Australia.

- (1) behind (2) from (3) off (4) on

問 3. The boy is [3] than angry.

- (1) more sad (2) much sadder (3) sad (4) sadder

問 4. They are twins but they don't look [4].

- (1) alike (2) equalized (3) equivalent (4) same

問 5. This workplace [5] an atmosphere of success.

- (1) comes off (2) gives off (3) makes off (4) puts off

問 6. When he came home, he realized that someone [6] into his house a few minute earlier.

- (1) had been broken (2) had broken
(3) has broken (4) was broken

第2問 次の問 1～4 においては、それぞれ日本語の意味に合うように下の(1)～(7)の語句を並べかえて空所を補い、適切な文を完成させなさい。解答は [7] ～ [14] に入れるものの番号のみをマークしなさい。ただし文頭にくる文字も小文字にしてある。

問 1. 彼は、浜辺にある役に立つものを全部ボートに積み込んだ。

He _____ [7] _____ [8] _____ the beach.

- | | | | |
|----------|----------------|------------|--------|
| (1) boat | (2) everything | (3) loaded | (4) on |
| (5) the | (6) useful | (7) with | |

問 2. 昨日うっかり数駅乗り過ごしてしまった。

I _____ [9] _____ [10] _____ by accident yesterday.

- | | | | |
|--------------|------------|----------|--------|
| (1) a | (2) couple | (3) far | (4) of |
| (5) stations | (6) too | (7) went | |

問 3. どのギターでも、買ったら見せてよ。

_____ [11] _____ [12] _____?

- | | | | |
|---------------|---------------|---------|----------|
| (1) buy | (2) guitar | (3) me | (4) show |
| (5) whichever | (6) would you | (7) you | |

問 4. 私がこれらのジグソーパズルを完成させるには普通 10 時間かかる。

_____ [13] _____ [14] _____.

- | | | | |
|-----------|--------------------|------------------|---------|
| (1) hours | (2) jigsaw puzzles | (3) me | (4) ten |
| (5) these | (6) to complete | (7) usually take | |

第3問 Read the dialogue and answer the questions that follow.

第3問の問題文は、著作権の都合により
掲載しておりません

<https://www.npr.org/transcripts/936638232> (改変あり)

注 uber: スーパー

insurmountable: 対処できないほどの

Thanksgiving: 感謝祭(アメリカやカナダにおける祝日の一つ)

問 1. Based on this conversation, what is the most likely relationship between these two speakers? Write the number of your answer in [15].

- (1) acquaintances (2) coworkers (3) husband and wife (4) parent and child

問 2. Based on the context, which word best fits (あ)? Write the number of your answer in [16].

- (1) boundaries (2) contradictions (3) distinctions (4) parallels

問 3. Based on the context, which of the following is most likely to be placed in (㇏)? Write the number of your answer in [17].

- (1) I missed a lot of things when she was growing up
(2) she is satisfied with the decisions that she has made
(3) society is changing with the advancement of technology
(4) we will keep working hard to buy her valuable things

問 4. Which of the following statements is closest to what speaker B says? Write the number of your answer in [18].

- (1) Speaker B felt pleased about his daughter's wise choice.
(2) Speaker B taught his daughter to respect her parents.
(3) Speaker B thought carefully before having a child.
(4) Speaker B was careful to let his daughter achieve her goals.

第4問 Read the article and answer the questions that follow.

In 2016, an inflatable arch wreaked havoc at the Tour de France bicycle race when it deflated and collapsed on a cyclist, throwing him from his bike and delaying the race while officials scrambled to clear the debris from the road. Officials blamed a passing spectator's wayward belt buckle for the arch's collapse, but the real culprit was physics.

Today's inflatable structures, used for everything from field hospitals to sporting complexes, are monostable, meaning they need a constant input of pressure in order to maintain their inflated state. Lose that pressure and the structure returns to its only stable form — flat.

But what if these structures had more than one stable state? What if the arch was just as stable inflated as it is flat on the ground?

Now, researchers at the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS) have developed bistable inflatable structures inspired by origami.

The research is published in *Nature*.

“This research provides a direct pathway for a new generation of robust, large-scale inflatable systems that lock in place after deployment and don't require continuous pressure,” said Katia Bertoldi, the William and Ami Kuan Danoff Professor of Applied Mechanics at SEAS and senior author of the paper.

Inspired by origami and guided by geometry, the research team developed a library of triangular building blocks that can pop up or fold flat and be combined in different configurations to build closed, multistable shapes.

“We are relying on the geometry of these building blocks, not the material characteristics, which means we can make these building blocks out of almost any materials, including inexpensive recyclable materials,” said Benjamin Gorissen, an associate in Materials Science and Mechanical Engineering at SEAS and co-first author of the paper.

(あ) their design process to the real world, the researchers designed and built an 8 foot by 4 foot inflatable shelter out of thick plastic sheets.

“You can imagine these shelters being deployed as part of the emergency response in a disaster zone,” said David Melancon, a PhD student at SEAS and co-first author of the paper. “They can be stacked flat on a truck and you only need one pressure source to inflate them. Once they are inflated, you can remove the pressure source and move onto the next tent.”

The shelter can be set up by one or two people, as opposed to the dozen or so it takes to deploy today's military field hospitals.

The building blocks of these origami structures can be mixed and matched to create a structure of any shape or size. The researchers built a range of other structures, including an archway, an extendable boom and a pagoda-style structure. The researchers also designed shapes with more than two stable forms.

“We've unlocked an unprecedented design space of large-scale inflatable structures that can fold flat and maintain their deployed shape without the risk of catastrophic rupture,” said Chuck Hoberman,

the Pierce Anderson Lecturer in Design Engineering at the Graduate School of Design and co-author of the paper. “By using inflatable, reversible actuation to achieve hard-walled structural enclosures, we see important applications, not only here on Earth, but potentially as habitats for lunar or Mars exploration.”

<https://www.seas.harvard.edu/news/2021/04/bistable-pop-structures-inspired-origami> (改変あり)

From Bistable pop-up structures inspired by origami by Leah Burrows from Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS), News, April 21, 2021. Copyright (c) 2021 President and Fellows of Harvard College. Reproduced by permission of SEAS.

- 注 inflate: ～を膨らます wreak havoc: 大惨事を引き起こす
 scramble: 急いで～する、慌てて～する debris: 破片、がらくた
 wayward: 外れた culprit: 犯人、原因 robust: 頑丈な
 configuration: 形態、配置 rupture: 破裂 actuation: 作動、駆動

問 1. Fill in the blank for (あ) with the word that best fits the context within the article. Write the number of your answer in [19].

- (1) Asking (2) Expecting (3) Returning (4) Taking

問 2. Choose the meaning of the underlined word “deployed” that best fits the context within the article. Write the number of your answer in [20].

- (1) destroyed (2) diverted (3) removed (4) utilized

問 3. Which of the following is NOT stated in the article about the inflatable structures developed by Harvard researchers? Write the number of your answer in [21].

- (1) The more they fold, the stronger their structures become.
 (2) They are compact enough to carry around easily.
 (3) They can be assembled into structures of various shapes and sizes.
 (4) They don’t need continuous pressure to stay inflated.

問 4. According to the article, which of the following statements is true? Write the number of your answer in [22].

- (1) It takes only a few seconds for specialists to set up one multistable shelter.
 (2) Newly-developed inflatable structures could potentially be used on another planet.
 (3) The cyclist was thrown from his bike, but the race went on without interruption.
 (4) The researchers created triangular building blocks by folding origami paper.

この後の第 5 問と第 6 問は記述用解答用紙に解答しなさい。

第5問 次の英文を読み、後の問いに答えなさい。

Being quite small, insects can deal with the air-water boundary far differently than larger animals do. Surface tension allows water striders, for instance, to skate along the top of still waters. But new research reveals something even stranger: Some insects move along this boundary from the underside.

【 あ 】

A water-dwelling beetle can scuttle upside-down along the underside of the water's surface. It's as if the water were a solid pane of glass, researchers report June 28 in *Ethology*. Their report is the first detailed report of a beetle moving this way (which only a few other species can do).

John Gould is a behavioral biologist. He works at the University of Newcastle in Callaghan, Australia. He never set out to look for beetles in the country's Watagan Mountains. He was just searching, one night, for tadpoles in natural pools of water. In one pool he spotted a black object smaller than a pinky nail.

"At first, I just assumed it must have been a bug that had fallen into the water and was swimming across the surface," Gould recalls. Then, he realized, "the bug was upside-down — and below the water's surface."

【 い 】

Gould quickly filmed the scene. As he did, the beetle — later identified as a water scavenger beetle — walked along the underside of the water's surface. It did so just as it would on a flat, solid surface. Now and then it rested. Sometimes it changed direction.

Later, Gould mentioned 《A》this encounter to Jose Valdez. A wildlife ecologist, Valdez works at the German Centre for Integrative Biodiversity Research in Leipzig. He thought Gould's observations were interesting. But 《B》he was not astonished by them. After all, Valdez had seen insects walk upright along the bottom of a body of water.

In fact, Valdez recalls, "I didn't fully grasp what [Gould] was describing until he showed me the video." Only then did he see the beetle was walking upside down along the underside of the water's surface. At that point, he says, "I was floored!"

【 う 】

Searching scientific reports, the two found that some snails could move along the underside of the water's surface. They did this by sliding on a layer of mucus. But there were only a few passing mentions of beetles doing this. And they came from research papers published decades ago.

《C》It's a publication gap that surprised Martin Fikáček. He's an entomologist at National Sun Yat-

sen University in Kaohsiung, Taiwan. The beetles' ability to walk along the underside of the water's surface is known to aquatic beetle specialists. In fact, he notes, they take advantage of it when collecting the beetles. Researchers will unsettle the pond bottom. The beetles respond by floating to the surface. There they skitter around upside-down, he notes. However no one had looked closely at the phenomenon, he admits.

"It's actually cool that somebody started to think about [how the beetles do this]," says Fikáček. "We always see it. And we never even thought about it."

Gould and Valdez think these beetles might use their water-walking superpower to stay far away from ambush predators that might lurk along the bottom of these pools. How the insect manages this feat remains unknown. But these scientists have an idea.

【 え 】

Gould's video showed an air bubble trapped along the creature's upturned belly. He and Valdez now think the bubble's buoyancy may be flipping and pinning the beetle to the underside of the water's surface. That might allow the insect to put pressure on the water-air boundary with every step. That might also explain tiny hills of water that Gould observed sprouting from the beetle's feet.

The beetle might indeed be pushing off against the water as the researchers describe, says Tom Weihmann. He's a movement physiologist at the University of Cologne in Germany. But that would mean the beetle's feet are attracted to water. That would contrast with its water-repellant body. "It would have been really interesting," he now says, "to know which parts of the animals are [water-repellant] and which are not." He'd also like to know about the anatomy of their feet.

【 お 】

Says Gould, these findings highlight how often we ignore or miss amazing things that small critters do every day. "Describing the natural history of the small is just as important as describing the natural history of any large mammal or bird."

<https://www.sciencenewsforstudents.org/article/beetles-walk-on-water-upside-down-underneath-surface/amp> (改変あり)

From Some beetles walk along the underside of the water's surface by Jake Buehler from Science News for Students, July 29, 2021.
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注 water strider: アメンボ
tadpole: オタマジャクシ
floor: ～を仰天させる
aquatic: 水棲の
ambush: 待ち伏せ
buoyancy: 浮力
water-repellent: 撥水性の

scuttle: 素早く動く
pinky: 小指
mucus: 粘液
unsettle: ～を掻き回す
lurk: 潜む
flip: ～をひっくり返す
critter: 生物

pane: 板
water scavenger beetle: ガムシ
entomologist: 昆虫学者
skitter: 滑るように進む
feat: 芸当
sprout: 突き出る

- 問 1. 下線部《A》が指す具体的内容を、本文の内容に即して日本語で説明しなさい。
- 問 2. Jose Valdez が最初下線部《B》のように反応したのは彼にどのような経験があったためか、本文の内容に即して日本語で説明しなさい。
- 問 3. 下線部《C》で述べられているように Fikáček が驚いたのは何故か、本文の内容に即して日本語で述べなさい。
- 問 4. 下線部《D》が生じるのは何故だと考えることができるか、本文の内容に即して日本語で述べなさい。
- 問 5. 次の段落は本文のどの位置に置くのが最も適切か、【あ】～【お】の記号で答えなさい。

Future research might reveal if the beetles can switch to the opposite side of the water-air boundary, leaving the water entirely. Additional studies on the physics of the beetle's upside-down water-walking skill could also inspire advances in robotics. Some robots already take moves from water striders.

第6問 次の英文を読み、下線部 (1) ～ (3) の日本語の内容を英語にしない。

Offshore wind farms will generate the equivalent amount of electricity produced by 30 to 45 nuclear reactors by 2040 under ambitious plans announced Dec. 15 to promote sources of renewable energy.

(1) その目標は今後 20 年で出力を現在の 10～20 メガワットから 30～45 ギガワットまで引き上げることである。

A committee comprising members of the public and private sector agreed on the new target and announced it later that day.

The target is part of a green growth strategy to be compiled by year-end to achieve Prime Minister Yoshihide Suga's recently stated goal of bringing down greenhouse gas emissions to net zero by 2050.

The government had set a target of having renewable energy account for 22 to 24 percent of the country's total energy generation mix by fiscal 2030. With the new goal of bolstering offshore wind power generation, calls for raising the overall target for renewable energy will likely grow further.

The beauty of offshore wind farms is that they can be built almost anywhere. Europe already generates more than 20 gigawatts in wind power, far outpacing Japan.

The Japanese government initially planned to increase the capacity to 820 megawatts by fiscal 2030, but will raise the target to 10 gigawatts by around 2030 and to 30 to 45 gigawatts by 2040.

(2) 政府は新たな長期目標を設定することで、洋上風力発電への投資事業を奨励している。

It set up the public- and private-sector committee in July to discuss ways to enhance the competitiveness of the industry.

Even though Japanese manufacturers withdrew from the business of producing wind turbines for offshore wind power generation, the government set a goal of domestically procured parts accounting for 60 percent of total outlays, including the costs for installing wind turbines, by 2040, according to sources.

The government also intends to reduce the financial burden on consumers by lowering the cost of offshore wind power generation to 8 to 9 yen per kilowatt-hour between 2030 and 2035.

Under the feed-in-tariff system, which requires electric utilities to buy power generated with renewable energy sources at fixed prices, (3) 電力供給源の開発費用が減らない限り、消費者はより高い電気料金を支払わざるを得ない。

The government will almost certainly need to coordinate with local fisheries cooperatives and other parties to build offshore wind farms and secure power lines to transmit electricity generated by those facilities to urban areas.

<http://www.asahi.com/ajw/articles/14021858> (改変あり)

注 bolster: ～を推進する

outlay: 支出

outpace: ～より進んでいる

feed-in-tariff system: 固定価格買取制度

procure: ～を調達する