東京医科歯科大学　医学部
歯学部

平成31年度入学者選抜個別(第2次)学力検査問題

外　国　語

注　意　事　項

1. 監督者の指示があるまで，この冊子を開いてはいけません。
2. 問題冊子は，全部で9ページあり，第1～3ページは下書用紙です。下書用紙は切り離してはいけません。
3. 問題は，第4ページと第5ページの間に，はさみこんであります。
4. 解答用紙は，問題冊子と別に印刷されているので，誤らないように注意しなさい。
5. 解答は，必ず解答用紙の指定された欄内に**横書き**で記入しなさい。
6. 各解答用紙には，受験番号欄が2または4か所あります。それぞれ記入を忘れないこと。
7. 解答用紙は，記入の有無にかかわらず，机上に置き，持ち帰ってはいけません。問題冊子は持ち帰りなさい。
8. 落丁または印刷の不鮮明な箇所があれば申し出なさい。

学科によって解答すべき問題が異なります。
説明に従って解答しなさい。

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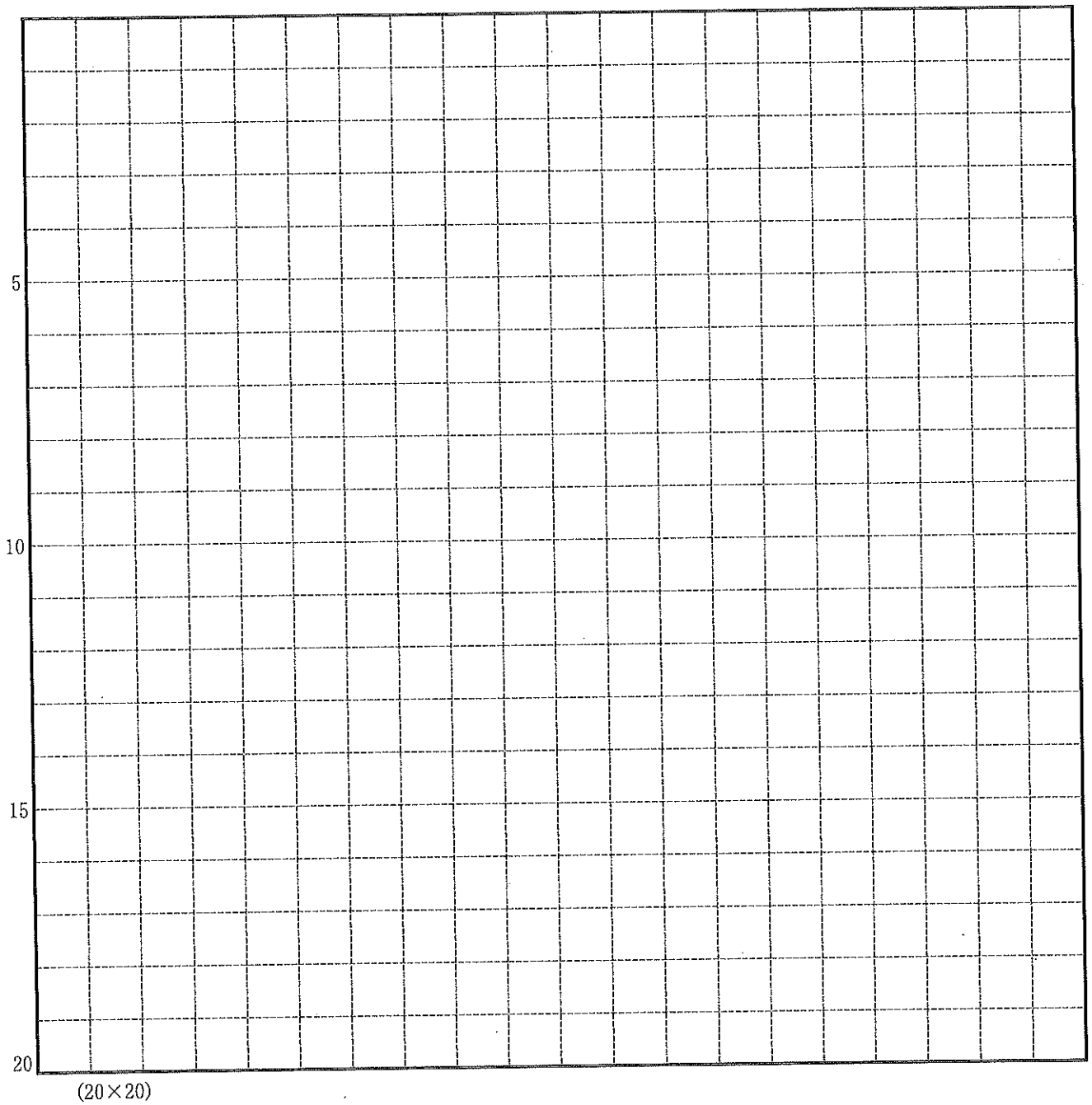

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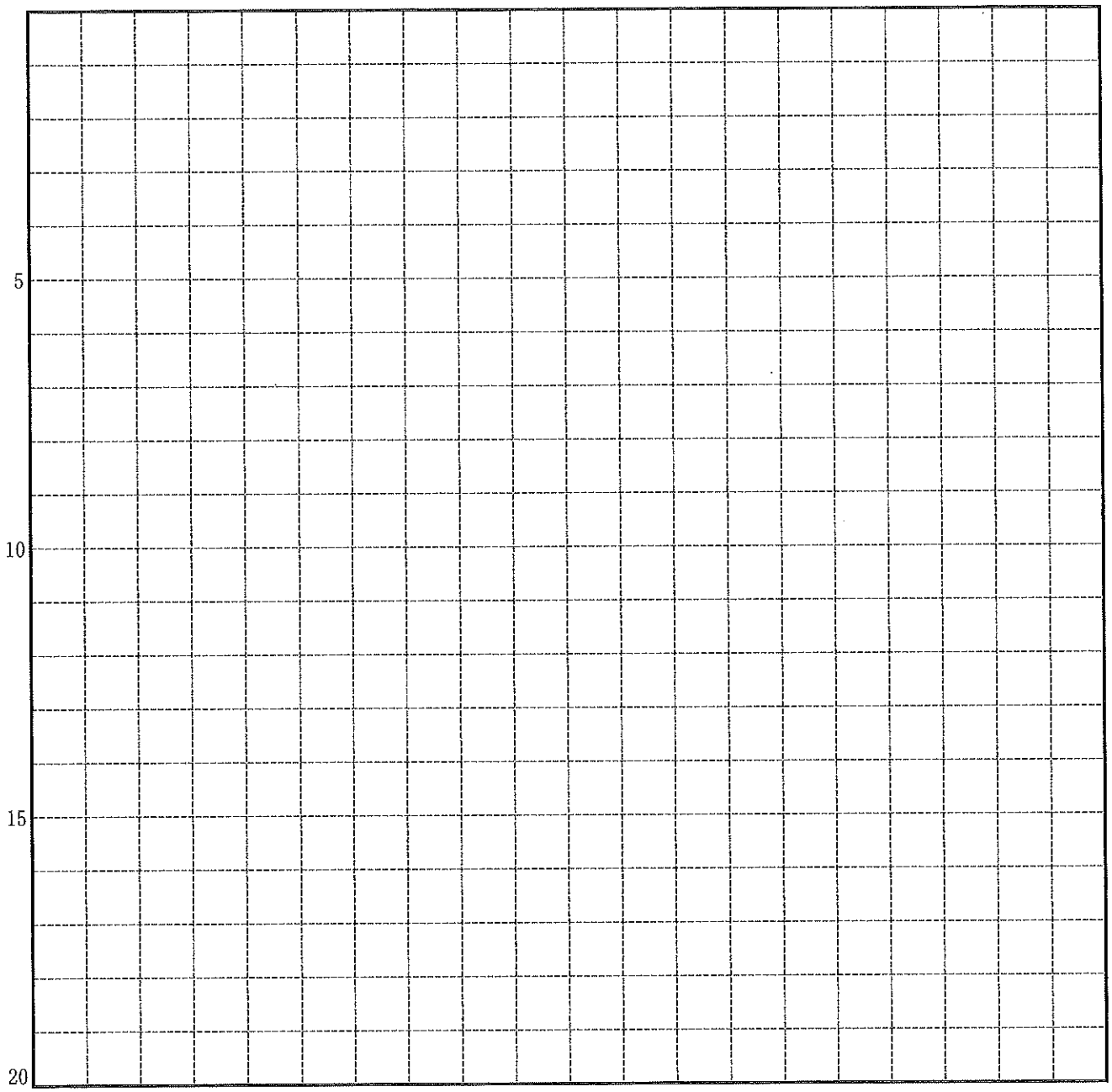

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外　国　語

次の英文は Cable News Network(2018 年 5 月 5 日)に掲載された“Can the building industry break its addiction to concrete?” (Thomas Page)の記事を一部改変したものです。この文章をよく読んで，医学科と歯学科の受験者は問題 3 , 4 , 5 , 6 に答えなさい。保健衛生学科と口腔保健学科の受験者は問題 1 , 2 , 3 , 5 , 6 に答えなさい。解答は解答用紙の指定された欄に記入すること。

Concrete: we can't live with it, can't live without it. A combination of cement, water and ground rock or sand, on the surface concrete might seem crushingly mundane. Yet it has defined construction in recent centuries and with **it**[1], in part, modernity.

But do we need to re-evaluate our concrete habit for our sakes and the planet's? Production of cement is disastrous for our biosphere, while the ***degradation*** of many concrete buildings has some construction experts predicting a colossal headache in the future.

(ア) There are many proposed solutions, such as changing the way we make concrete, creating sustainable alternatives or doing away with it altogether. But would we want to live in a world without concrete? And what would that world look like?

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"We make more concrete than anything else, any other product, apart from clean water," says Paul Fennell, professor of clean energy at Imperial College London. One 2015 report estimates that each year approximately three tons of concrete are used for every person on Earth — roughly, 22 billion tons. To put that in context, a recent study estimated that 8.3 billion metric tons of plastic have been produced, ever.

Manufacturing cement, concrete's binding agent, is energy-intensive, Fennell

says. Ordinary Portland cement — the most common form in concrete — is produced by baking lime in a kiln and emits approximately one ton of carbon dioxide for every ton of cement. Cement production is responsible for approximately 5% of global man-made CO_2 emissions, according to the World Business Council for Sustainable Development.

Cement does absorb some carbon dioxide back from the atmosphere over time, Fennell notes. One 2016 study estimated that between 1930 and 2013, the ***equivalent*** of 43% of CO_2 released from lime during heating was reabsorbed by concrete products worldwide — although that percentage does not include carbon dioxide emitted by the fossil fuels burned to heat kilns, a significant contributor of CO_2 emissions during production.

Unfortunately, this absorption comes at a price, particularly when cement is used in structures that ***feature*** steel reinforcement bars (rebar) within concrete.

"(As) CO_2 moves through cement **it**[2)] changes the pH of the surroundings," Fennell says. Concrete loses its alkalinity and, when moisture and oxygen are present, causes the rebar to rust.

"Rusting steel can expand with great force to as much as nine times its original dimensions if you add up all of the layers of iron oxide," says Randolph Langenbach, an international consultant in building conservation. This expansion causes the concrete to crack, flake and crumble.

Degradation is a massive concern, he argues, and problems are not limited to rusting rebar. Everything from air pockets left in the concrete mix when it's laid, to salt air buffeting coastal-facing walls, or the use of beach sand in the concrete, can shorten a building's lifespan.

As one specialist once put it to Langenbach: "If it ain't cracked, it ain't concrete."

* * *

Given the concerns about the environmental impact and structural longevity of concrete, why do we continue to build with it?

Simply put, concrete is cheap, versatile, quick to erect and requires no additional fireproofing. It's also a known entity, and that carries a lot of weight. So-called "novel" cements, some with "greener" formulas, have been developed, but ***radical*** changes to industry standards are likely to be met with caution by constructors, Fennell argues.

"If you want to build the next Burj Khalifa, you're not going to get any of these new types of cement in there for a long time," says Fennell, "because people don't know how **they**[3] will stand up to 20 or 30 years' worth of degradation." A 2017 report commissioned by the UK government failed to identify any publicly available lifecycle studies focusing on novel cements, for instance.

Langenbach has a more skeptical take. "Making concrete (...) is a huge business, so much so that it's sort of become identified as the mafia — at least in this country (the US)." Historically, there have been connections to the New York mob, and there's certainly still money to be made. The USGS estimates cement sales for concrete in 2017 were "worth at least $65 billion" in America alone.

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Some architects are trying to solve the concrete problem by ***pursuing*** more sustainable materials — both old and new.

Californian firm Aidlin Darling Design prides itself on its ethical architecture, and co-designed the Windhover Contemplation Center, an award-winning spiritual refuge at Stanford University built with colossal rammed earth walls.

Rammed earth, a combination of unbaked materials — such as gravel, sand and clay — and locally-sourced earth, compressed within a frame, has been used as a building material for thousands of years. Recently, **it**[4] has experienced a ***revival*** in high-end construction.

"It's art and science all in one," says partner Joshua Aidlin, describing the low-impact material. Windhover's walls are 24 inches thick and "ended up being denser than many of our concrete walls," says Aidlin — but notes that there were "hurdles" in having the building approved by authorities, because they weren't

familiar with it.

The reprisal of old — sometimes ancient — building materials and techniques could be ***crucial*** for sustainability. Langenbach specializes in post-earthquake surveying and disaster recovery. He says vernacular architecture — specific to residents' needs and utilizing local building resources—is often highly resilient, citing 700 to 1,000-year-old unfired clay construction in Iran that has ***withstood*** serious tremors while newer buildings collapsed.

Haiti's 19th and 20th century "gingerbread houses" provide another example, Langenbach adds. Those built with the "colombage"— or half-timber — system fared particularly well in 2010's devastating earthquake, he says. The Oloffson Hotel, a famous Gothic-style Gingerbread mansion built with un-reinforced brick masonry, remained operational when the rest of the country ground to a halt.

However, Evan Reis, a structural engineer and executive director of US Resiliency Council, says that statistics show that concrete structures are far better at withstanding earthquakes than unreinforced brick buildings.

He argues that concrete's resiliency to natural disasters also contributes to its sustainability.

"Concrete has been shown to be very resilient to earthquakes, hurricanes, floods, fires, and if you're looking at sustainability in the long term, you have to look at how likely a building is to survive those disasters," he told CNN.

"If a building is damaged and has to be ***demolished*** then there's an environmental cost in the energy required to demolish the building, to haul the stuff to a landfill and to replace the destroyed building. So it's not all about the initial environmental cost of the building, it's the long-term value of the building.

"If you have to replace a building multiple times over 50 or 100 years, how green is it in the end?"

* * *

A Japanese design firm has injected silica with carbon dioxide to produce a purportedly carbon-negative building material; a Dutch team is experimenting with

"living" concrete that self-heals; "CO2NCRETE" made with "upcycled" carbon dioxide has been developed in the UK; hemp and lime have been combined to produce "Hempcrete"; and Enviroblocks have been produced from recycled aggregates. Various materials that ***incorporate*** graphene — the world's strongest material — are also being developed.

Such high-tech solutions sound promising, but the road to mainstream acceptance is littered with alternatives that never stuck — either because they couldn't scale up or make their bottom line work. Perhaps producing and using concrete in a more sustainable way is the answer?

"Cement is key to modern society," says Fennell. "We need to work out a way to make it more sustainable at source." The cement industry, he adds, has been reducing its CO_2 emissions by burning biogenic waste — organic materials such as agriculture by-products — in cement kilns.

Project LEILAC (Low Emissions Intensity Lime and Cement) is a European initiative that is developing technology to capture and store the carbon dioxide produced by cement production — rather than release it into the atmosphere. Fennell says carbon capture techniques, combined with alternative fuels, could help achieve an EU target of cutting emissions to 80% below levels recorded in 1990 by 2050.

Increasing the lifespan of concrete buildings would also ease the burden. Concrete can withstand the ravages of time if applied correctly. The Pantheon in Rome, which boasts the world's largest unreinforced concrete dome, has stood for nearly 2,000 years. But few modern structures can match **this engineering marvel**.[5)]

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So can we really live without concrete? Langenbach is not optimistic. "We have built so many reinforced concrete structures, and are continuing to build them, probably for the next 75 to 100 years more, particularly in China," he says. "These buildings are almost all likely to have to be replaced or undergo significant

structural repairs to their reinforced concrete frames within 50 to 150 years. Your eyes grow wide when you think of the scale."

Aidlin has similar reservations. "It's the quickest, the easiest (material) to build with," he says, particularly in parts of the developing world and where resources are scarce. "But I would never say never," he offers, more in hope than expectation.

For the moment, at least, it feels like concrete is here to stay — even if most (イ) of the buildings made with it are not.

問　題

保健衛生学科と口腔保健学科のみ

1 ***The following words appear in bold italics in the text. On the answer sheet, circle the letter indicating the best definition for each word (based on how the word is used in the text).***

degradation

a) addiction　b) deterioration　c) formation
d) qualification　e) reduction

equivalent

a) amount　b) energy　c) equal
d) mass　e) production

feature

a) contain　b) damage　c) impact
d) require　e) support

radical

a) complex　b) costly　c) dangerous
d) fundamental　e) unnecessary

pursuing

a) buying　b) comparing　c) discussing
d) promoting　e) seeking

revival

a) comeback　b) happening　c) outcome
d) setback　e) setup

crucial

a) disastrous　b) endurable　c) trendy
d) vital　e) welcome

withstood

a) avoided　b) experienced　c) produced
d) reduced　e) tolerated

demolished

a) destroyed　b) examined　c) rebuilt
d) repaired　e) undertaken

incorporate

a) excrete　b) include　c) increase
d) make　e) simulate

保健衛生学科と口腔保健学科のみ

2 ***What do the following words, which are underlined in the text, refer to? Answer using one to five English words that can replace the underlined word(s).***

1) it　　2) it　　3) they

4) it　　5) this engineering marvel

全学科

3 ***According to the text, decide whether the following statements are true (T) or false (F). For each statement circle the correct answer on the answer sheet.***

1) According to Paul Fennell, clean water is the only product people produce more of than concrete.

2) A 2015 report shows that every person on earth uses approximately three tons of concrete per year.

3) About 2.6 times more concrete is produced per year than plastic.

4) According to Fennell, it takes a lot of energy to produce cement.

5) Making cement involves baking lime and carbon dioxide in a kiln.

6) According to a 2016 study, about 43% of CO_2 emitted from lime during cement production is absorbed by concrete products over time.

7) Concrete sometimes cracks from pressure caused by expansion of rusting steel rebars.

8) The article implies that beach sand is not an ideal component of concrete.

9) According to the article, one advantage of concrete is that it doesn't take a lot of time to build things with it.

10) Constructors avoid using new types of cement because of their shorter lifespans.

11) According to Fennell, new types of cement take a long time to degrade.

12) The article implies that there are no studies available to the public concerning the longevity of novel cements.

13) Rammed earth is a new building material invented by the California-based Aidlin Darling Design.

14) One difference between rammed earth and concrete is whether the materials have been baked or not.

15) The article implies that it was difficult to get the Windhover Contemplation Center approved by authorities because they didn't know enough about rammed earth.

16) The article defines "vernacular architecture" as architecture that uses materials found in the local community and is designed for the needs of that community.

17) According to Randolph Langenbach, one advantage of vernacular architecture is that it doesn't catch on fire during earthquakes.

18) Haiti's "gingerbread houses" are an example of vernacular architecture.

19) In Haiti, the famous Gothic-style Oloffson Hotel was devastated by an earthquake in 2010 due to its brick masonry.

20) Evan Reis seems to argue that concrete is actually an environmentally-friendly building material.

21) Project LEILAC is developing technology to produce cement without releasing carbon dioxide into the atmosphere.

22) According to Fennell, using alternative fuels to capture carbon may enable the European Union to reach its CO_2 emission goal by 2050.

23) Langenbach claims that we have built too many buildings in China to replace them using concrete.

24) Joshua Aidlin seems to hope more concrete structures will be built in the developing world.

医学科と歯学科のみ

4 ***Briefly (in 10 to 25 words) answer the following questions in your own words, using complete English sentences. Base your answers on the information presented in the article.***

1) Why are new cements not widely used in concrete?

2) Why is Evan Reis in favor of using concrete as a building material?

3) According to the article, what are some possible ways to produce and use concrete more sustainably?

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5 下線部(ア)と(イ)を日本語に訳しなさい。

全学科

6 コンクリートに関する問題点と，その解決策について，この記事の著者が述べていることを，以下のキーワードをすべて用いて日本語で400字以内にまとめなさい。**なお，キーワードは初出の際に四角く囲むこと。**

※英数字は2文字で1マスとしなさい。ただし，CO_2のみ1マスに入れてよい。

CO_2

持続可能性

代替