

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. Adult [1] Jane was at that time, she still enjoyed playing with dolls.

- (1) as (2) enough (3) while (4) who

問 2. John found the dictionary his mother had bought [2] great use.

- (1) at (2) of (3) on (4) with

問 3. It is necessary for new students to be [3] that submitting this assignment is mandatory.

- (1) recalled (2) recollected (3) rehearsed (4) reminded

問 4. That bridge was believed to be safe to [4] during a tornado.

- (1) stay (2) stay under (3) staying (4) staying under

問 5. The contestants spelled so many words [5] that the judges could not accept their answers.

- (1) careless (2) pointless (3) poor (4) wrong

問 6. The young man was elected [6] of the capital city.

- (1) a mayor (2) mayor (3) mayors (4) the mayors

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、最も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. 今のところ彼らと話す予定は無いが、必要ならそうしても一向に構わない。

At present, I am not planning to talk to them, but I _____ [7] _____
[8] _____.

- | | | | |
|-----------|--------|-------------|----------|
| (1) am | (2) be | (3) if | (4) need |
| (5) quite | (6) to | (7) willing | |

問 2. 彼女は兄がくれたステッカーを壁から引きはがした。

She _____ [9] _____ [10] _____.

- | | | | |
|-----------------|--------------|-----------------|---------|
| (1) gave | (2) her | (3) her brother | (4) off |
| (5) the sticker | (6) the wall | (7) tore | |

問 3. 規則を破ると面倒なことになるぞ。

_____ [11] _____ [12] _____.

- | | | | |
|---------------|-------------|------------|--------|
| (1) and | (2) break | (3) get | (4) in |
| (5) the rules | (6) trouble | (7) you'll | |

問 4. 彼が一度でも褒めたことがある映画であれば、他の人にほとんどけなされない。

_____ [13] _____ [14] _____ by others.

- | | | | |
|---------|----------------|------------------|---------|
| (1) are | (2) criticized | (3) ever praised | (4) has |
| (5) he | (6) movies | (7) seldom | |

第3問 Read the radio interview transcript 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

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

注 unveiling: 発表
livestock: 家畜

aroma: 香り
tinker with: ～をいじる

appetizing: おいしそうな

問 1. Based on the context of the interview, which phrase best fits (あ)? Write the number of your answer in [15].

- (1) conventional laboratories
- (2) food disposal facilities
- (3) the animals themselves
- (4) using typical meat alternatives

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

- (1) continue to eat exactly as we do now
- (2) prevent other species from becoming extinct
- (3) return to using our ancestors' farming techniques
- (4) start to eat things that aren't possible now

問 3. Which statement is closest to what is mentioned in the interview about the mammoth meatball?
Write the number of your answer in [17].

- (1) As it was developed using advanced techniques, strict testing was not needed.
- (2) It is a unique type of plant-based meat alternative that tastes very similar to meat.
- (3) Scientists created it by utilizing the genome of an animal related to mammoths.
- (4) The protein it was made from won't exist on our planet 4,000 years from now.

問 4. Which statement is closest to what is stated by Tim in the interview? Write the number of your answer in [18].

- (1) It is possible that people may eventually become extinct unless we change our eating habits.
- (2) Mammoths were able to be brought back from extinction by filling in gaps in their genome.
- (3) The mammoth meatball created by Vow has a scent that is very similar to the meat of a cow.
- (4) Vow's factory was able to produce many mammoth meatballs by first growing 40 billion cells.

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

Off Australia's northern coast, the skeletal remains of ancient coral reefs form the bedrock of numerous wooded islands. These low-lying tropical oases are home to diverse animals and plants, including mangrove forests that pepper their coasts and serve as vital habitat and carbon storers. A recent survey of one cluster of those islands — the first in 50 years — shows that swelling seas might have led to a massive mangrove (あ), researchers report November 1 in *Proceedings of the Royal Society B*.

In other parts of the world, rising seas have put mangroves at risk. But at the Howick Islands in the Great Barrier Reef, the story is different because of its unique geologic history.

“We usually are focusing on areas of mangrove loss,” says Temilola Fatoyinbo, a forest ecologist at NASA's Goddard Space Flight Center in Greenbelt, Md., who was not involved with the study. “So it's always encouraging to see areas where there's mangrove gain.”

Mangroves — groupings of different plants that have adapted to thrive along coastlines — soak up carbon dioxide and store it as “blue carbon,” a term for carbon that is sequestered in marine environments.

“There's a lot of interest in using mangrove blue carbon to mitigate climate change,” says Kerrylee Rogers, an environmental scientist at the University of Wollongong in Australia. “But there remains a lot of questions around their capacity to adapt to sea level rise.”

In 2021, a team led by Wollongong environmental scientist Sarah Hamylton visited the Howick Islands to see how the mangroves there are coping with sea level rise. Hamylton flew a drone over the mangroves to capture aerial imagery, while others walked through the water to assess the plant diversity and measure individual trees. Using the measured widths and heights of several mangroves, the team extrapolated tree widths for the rest of the forest from the drone's height data to estimate the total mangrove biomass.

The islands host nearly 54,000 metric tons of mangroves, the team estimates, which is roughly 10,000 more metric tons than was there in 1973. The forest's reach has also expanded on many islands. While about 25 hectares of every 100 on Newton Island were covered by mangroves in 1973, for example, the forest now blankets close to 40 hectares out of 100.

The Howick Islands are uniquely suited to supporting mangroves as the ocean rises. At the end of the Last Glacial Maximum, around 12,000 years ago, water levels rose around northern Australia, and coral reefs grew upward to fill the space that had opened for them. When sea levels fell thousands of years later, the exposed reefs eroded into sediment. With sea levels now rising again, the researchers suspect the mixture of saltwater and sediment makes a perfect home for the salt-tolerant mangroves.

“As sea level came back down, it wasn't suitable mangrove habitat,” Rogers says. With those parts of the island now submerged, “it now is suitable, and it's largely because it was set up for those conditions 2,000 to 4,000 years ago.”

The new findings highlight the need for mangrove research on a local scale, Rogers says. “In a global model, this would get lost.” Fatoyinbo agrees. “Studies on the local scale are really useful,” she says, “to better understand big patterns.”

- 注 coral reef: 珊瑚礁 pepper: ～一带に分布する sequester: ～を隔離する
extrapolate: ～を推定する biomass: 生物量
the Last Glacial Maximum: 最終氷期極大期 sediment: 堆積物
submerge: ～を水没させる

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) destruction (2) expansion (3) extinction (4) transplantation

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

- (1) accelerate (2) respect (3) support (4) weaken

問 3. In the Howick Islands, what did the team of scientists estimate? Write the number of your answer in [21].

- (1) the number of organisms in its waters
(2) the rate of sea level rise
(3) the salt level of the seawater
(4) the size of the mangroves

問 4. What was responsible for the mangrove habitat changes in the Howick Islands? Write the number of your answer in [22].

- (1) the fact that blue carbon has increased due to the growth of the surrounding forests
(2) the fact that parts of the islands that were once coral reefs are submerged again
(3) the fact that the sea level has dropped and more of the mangroves are exposed to the air
(4) the fact that the total mangrove biomass has increased due to more organisms living near the mangroves

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。

The elusive ^{《A》}Planet Nine, which is theorized to be lurking somewhere in the outer reaches of the solar system, may not be a planet after all, a new study suggests. Instead, what we assumed to be a massive object could be evidence that gravity doesn't work like we thought it does. But the new theory doesn't sit well with everyone.

【 あ 】

The Planet Nine hypothesis, first proposed in 2016, argues that the unusual orbits of objects in the Kuiper Belt beyond Neptune, which seem to be being pulled away from the sun, can be explained by the presence of an undiscovered ninth planet up to 10 times more massive than Earth. Astronomers have been looking for Planet Nine ever since. However, despite searching almost half of the night sky, they have so far come up empty-handed.

In the new study, published Sept. 22 in *The Astronomical Journal*, researchers proposed another explanation for the gravitational anomalies observed in the outer solar system — that there aren't any anomalies. Instead, the team shows that the inconsistencies disappear completely when applying an alternative concept of gravity known as ^{《B》}modified Newtonian dynamics (MOND).

【 い 】

Isaac Newton's law of universal gravitation states that gravity tugging on an object is inversely proportional to the square of the distance between the object and the object that is pulling it, meaning that gravity gets weaker as the distance between the two objects increases. But MOND tweaks this and suggests that past a certain distance, the gravitational pull begins to become closer to being inversely proportional to the distance itself, which means the strength of the gravitational pull does not drop off as quickly as traditional Newtonian dynamics predicts. This suggests that objects orbiting a larger object at great distances, such as stars on the outskirts of spiral galaxies like the Milky Way, would experience a greater gravitational pull than the Newtonian law of universal gravitation would suggest.

According to MOND, then, Kuiper Belt objects are actually being pulled by the rest of our galaxy, rather than by an undiscovered planet.

The researchers were surprised by their findings. The initial aim of their study was to “rule out” MOND as a possible explanation for Planet Nine. However, when they applied it to the problem, it seemed to solve the issue perfectly.

【 う 】

“MOND is really good at explaining galactic-scale observations,” study author Harsh Mathur, a

theoretical physicist at Case Western Reserve University in Ohio, said in a statement. “But I hadn’t expected that it would have noticeable effects on the outer solar system.”

MOND was first proposed in 1983 as an alternative to dark matter — the invisible particles of unknown origin that supposedly makes up 27% of all matter in the universe, according to NASA. Dark matter was proposed to explain the “missing mass problem,” which arose when astronomers realized that stars and planets alone could not explain the observed gravitational pull of galaxies. But MOND suggests that if distant objects are experiencing a greater gravitational pull, then there may not be as much missing mass as we originally thought.

【 え 】

Not everyone is convinced by this latest Planet Nine theory.

“I would be delighted with the idea that what we thought was Planet Nine was really new physics,” Michael Brown, an astronomer at Caltech who co-proposed the Planet Nine hypothesis, wrote in an email. “But I suspect that the chances of this being true are low,” he added.

MOND is not the only alternative explanation for Planet Nine that has popped up in recent years. Some experts have proposed that the hypothetical planet is actually a mini black hole that is pulling the surrounding objects inward.

【 お 】

But whether MOND is the answer to the Planet Nine mystery or not, the study team believes that the concept has a role to play in further understanding our cosmic neighborhood.

“Regardless of the outcome, this work highlights the potential for the outer solar system to serve as a laboratory for testing gravity and studying fundamental problems of physics,” study author Katherine Brown, a theoretical physicist at Hamilton College in New York State, said in the statement.

Live Science (2023/10/16): Future Publishing Ltd

注 lurk: 潜む

Kuiper Belt: カイパーベルト

Neptune: 海王星

gravitational anomaly: 重力異常

law of universal gravitation: 万有引力の法則

tug on: ～をぐっと引く

inversely proportional to: ～に反比例して

square: 2 乗

tweak: ～を微調整する

outskirt: 外縁

Milky Way: 天の川

cosmic: 宇宙の

問 1. 下線部 《A》を仮定する動機となった事実はどのようなものか、本文の内容に即して日本語で答えなさい。

問 2. 下線部《B》は、本来どのような問題を解決するために提案されたものか、本文の内容に即し 30 字から 40 字の日本語で説明しなさい。

問 3 下線部《B》の下では下線部《A》の存在を仮定する必要が無いのは何故か、本文の内容に即し、以下の空欄を埋める形で答えなさい。

ニュートン力学では、2つの物体の間に働く引力は、その距離の2乗に反比例する。それに対し、下線部《B》は、ある距離以上離れると と示唆するため、引力の大きさは、ニュートン力学が想定するほど と考えられる。したがって、下線部《A》によるとされた引力は の質量によって説明される。

問 4. 下線部《B》を仮定しない立場では、下線部《A》の「正体」としてどのようなものが考えられているか、本文中に言及のある例を2つ日本語で挙げなさい。

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。

However, MOND cannot explain all of the universe's missing mass and thus cannot completely rule out the idea of dark matter. And other studies suggested that to reconcile MOND with quantum mechanics and relativity, “funky” stuff needed to be added to existing theories, and some of those additions are problematic.

注 quantum mechanics: 量子力学

relativity: 相対性理論

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てください。

Cultured meat is attracting attention in Japan, as global population growth and improvements in living standards push up demand for meat. Unlike soybean meat and insect food, cultured meat is made from real meat such as beef, pork and chicken. Also, it can be produced anywhere as long as there is electricity, culture solution and livestock cells, boosting hopes for the product as a new source of protein.

Although this is still in the research stage in Japan, (1)シンガポールは2020年12月に培養肉の販売を承認した世界初の国となり、その後商業生産を開始した。 Development competition is intensifying around the world, including the United States and European countries. Demand for meat in 2050 is expected to rise 70% from 2015. According to Japan's agriculture ministry, the domestic market for cultured meat is projected to reach ¥9 billion in 2050, while the global market is seen reaching ¥700 billion.

The Japanese government is eager to foster cultured meat production as a future growth industry. The Ministry of Economy, Trade and Industry provides financial support for technological development, viewing the business as part of "bio-manufacturing." The agriculture ministry, for its part, has set up a public-private council on food technologies in order to support cultured meat production. "The aim is to help producers meet food demand while contributing to the economy," a senior ministry official said.

If a sterile culture plant is built, production of cultured meat does not require farmland and is little affected by external factors such as weather. NUProtein Co., based in Tokushima, is involved in the development of cultured meat technology. "If the industrialization of cultured meat makes headway and mass production starts, it could lead to regional revitalization by attracting factories to rural areas where vast land plots are available for use," Masataka Minami, CEO of NUProtein, said.

Megumi Avigail Yoshitomi, representative director of the Japan Association for Cellular Agriculture, which is working on rules for cultured meat, said that if livestock farmers who own meat brands donate cells, there will be a business opportunity for licensing. (2)培養肉の分野での細胞やブランドに適切な価格がつけられるためには、それらが不正使用されないことを保証する仕組みが必要だ、" Yoshitomi said.

It is also essential to improve the public image of cultured meat. According to a survey conducted by major Japanese meatpacker NH Foods Ltd. in November last year, of 324 people aged 20 or older nationwide, 42.9% felt that cultured meat was "less delicious" than conventional meat.

Drawing up rules related to the distribution of lab-grown meat, including those on food labeling and measures for safety, has been taking time. "Businesses can't start mass production unless the government shows its policy," Yoshitomi said. (3)しかし、政府はまず企業が大量生産に向けて十分に準備することを望んでおり、議論は堂々巡りしたままである。"

注 livestock: 家畜

meatpacker: 精肉出荷業者