令　和　6　年　度

医　学　科

外　国　語(英語)

注意事項

1. 問題は 1 頁から 13 頁に掲載されています。
2. 解答に用いる言語(日本語あるいは英語)は各設問の指示にしたがって選びなさい。ただし，記号で答えるように求められている場合は記号で答えなさい。
3. 解答は解答用紙に記入しなさい。

<パート1>　　(配点率 40 %)

次の英文を読んで，設問に日本語あるいは記号で答えなさい。

Change is in the air for Major League Baseball (MLB), with numerous new rules going into effect this season aimed at speeding up play and making games more action-packed. But a new study finds that the air itself has also been changing baseball — by making home runs slightly easier to hit.

The study, published Friday in the *Bulletin of the American Meteorological Society*, analyzed more than 100, 000 major league games and [1]attributed 577 home runs hit between 2010 and 2019 to warming caused by climate change. That figure represents around 1 percent of a typical MLB season's total home runs.

"This effect has been small to date, but the influence of climate change will only become more substantial going into the rest of the century," says Christopher Callahan, a climate scientist at Dartmouth College and the study's lead author. "This study is somewhat *lighthearted, but it illustrates the [2]pervasive and subtle influence of climate change on our daily lives."

By raising average global temperatures via enormous greenhouse gas emissions, humans have also reduced the average *density of air, which becomes less dense as it heats up. Warmer, lower-density air means a hypothetical home run hit to left field experiences less air resistance or drag, because there are fewer air molecules between the ball and the *stands. Any reduction in drag allows the ball to travel farther.

*Emeritus University of Illinois physicist and baseball researcher Alan Nathan, who wasn't involved in the study, says a ball that explodes off a hitter's bat at 161 kilometers per hour with a launch angle of about 25 to 30 degrees will travel roughly 122 meters through the air at sea level on a roughly 21 ℃ day. The same ball traveling through 38℃ air would carry roughly three additional

meters. If no air resistance slowed the ball down — in a hypothetical vacuum — it would sail an additional 91 meters, Nathan says.

This study is far from the first time that this idea of hotter weather increasing home run *stats has been proposed, but an ever-growing wealth of data in modern baseball and an increasingly powerful set of statistical methods for analyzing the impacts of climate change are now available.

These developments, combined with an everlasting love of America's national pastime, led Callahan to seek out an answer to just how many more home runs are being hit in MLB because of the roughly one degree *Celsius of warming Earth has already experienced since 1880.

The researchers selected baseball data from more than 100, 000 major league games between 1962 and 2019 and 220, 000 individual hits from 2015 to 2019. Then the team looked for game day temperatures that were considered unusually warm for the particular *locale and season. The team analyzed this data to look for correlations between home runs and temperature while controlling for a host of other *variables, such as stadiums with different *dimensions, the rise of steroid use and players altering their swings to hit more balls out of the park. ①This created an estimate of the contribution of air temperature to the home runs hit in MLB across decades.

To *single out the contribution of human-caused climate change to those hot-weather home runs, Justin Mankin, a climate scientist at Dartmouth and the study's *senior author, says they used climate models to simulate a world in which humans hadn't pumped greenhouse gases into the atmosphere. Comparing this counterfactual Earth to actual temperature data allowed the researchers to estimate just how much warmer a given day was due to climate change, and then to calculate how that extra warming increased the number of home runs hit.

Callahan and Mankin found an average of 58 home runs per year between 2010 and 2019 — 577 total — that likely wouldn't have made it out of the park without the assistance of climate change. The study also used different

scenarios to estimate the effect of climate-change-induced warming on home runs all the way out to the year 2100.

They found that if greenhouse gas emissions keep climbing and major changes aren't made to how baseball is played, climate homers could [3]account for nearly 10 percent (437 home runs) of the yearly total in MLB. That pessimistic emissions scenario would entail nearly four degrees Celsius of warming compared to the pre-industrial era and up to one meter of sea level rise.

By contrast, strong climate control would lead to a temperature increase by 2100 of about two degrees Celsius and would add roughly 130 home runs to the annual total.

"Whether you think more home runs are good or bad as a baseball fan, this finding hides the much more serious risks of global warming," says Mankin. "Baseball is a game enjoyed outdoors, usually during daytime, and to the extent that the ball will fly farther on a hot day, so too is an elderly person at greater risk of heat stroke or heat stress."

Night games, the paper suggests, could help mitigate the impacts of increasing daytime high temperatures. Some teams have already taken concrete steps to mitigate the impacts of heat at their ballparks. The Texas Rangers, for instance, opened a new domed ballpark featuring a massive air conditioning system in 2020 to fend off *scorching outdoor temperatures that once exceeded 38 degrees for 40 straight days in 2011. Air-conditioned domes would also largely eliminate the increase in home runs expected under climate change.

As temperatures continue to climb in the coming decades, more and more MLB teams could [4]opt for domed stadiums, rendering America's pastime an indoor sport at the professional level.

"To me, one of the joys of baseball is being in the open air in the sunlight," says Callahan. "I think something would be lost if it was played indoors. Climate change is going to continue changing our lives in ways that aren't always disastrous but are often sad."

Source (excerpt with changes) :

Fox, A. (2023, April 7). Climate change is making home runs easier to hit. *Smithsonian Magazine*. https://www.smithsonianmag.com/science-nature/climate-change-is-making-home-runs-easier-to-hit-180981949

Notes :

lighthearted : 肩のこらない
density : 密度
stands : 観客席
emeritus : 名誉退職の
stats : 統計値
Celsius : 摂氏
locale : 場所
variables : 変数
dimensions : 面積
single out : 選び出す
senior author : 最終著者
scorching : 焼けつくような

設問 1　次の語は，本文の文脈ではそれぞれどのような意味で使われているか，最も近いものを選んで解答用紙の記号を○で囲みなさい。

(1) attributed

(a) allotted

(b) applied

(c) credited

(d) compared

(2) pervasive

(a) slight

(b) limited

(c) positive

(d) widespread

(3) account for

(a) change

(b) increase

(c) consider

(d) constitute

(4) opt for

(a) be satisfied with

(b) come across

(c) be patient with

(d) make a choice of

設問 2　下線部①は何を指しているか，本文の内容にしたがって説明しなさい。

設問 3　温暖化が進む中，野球に関してどのような対策が可能か，本文の内容にしたがって説明しなさい。

設問 4　本文の内容と合致するものを 3 つ選んで解答用紙の記号を○で囲みなさい。4 つ以上選んだ場合は 0 点とする。

(a) Callahan thinks that playing baseball indoors is disastrous.

(b) On a hot day when the ball flies farther, there is a greater risk of heat stroke for seniors.

(c) Callahan and Mankin compared a simulated Earth without greenhouse gases with actual data.

(d) Callahan and Mankin detected 58 home runs in 2010-2019 which were assisted by climate change.

(e) If strong measures are taken to cope with global warming, 130 climate homers would be added to the annual total by 2100.

(f) In the worst case scenario of greenhouse gas emissions, the temperature could rise four degrees Celsius in comparison to the temperature now.

(g) A ball hit at 161 kilometers per hour with a launch angle of 25-30 degrees would travel roughly 91 meters through 38℃ air, if no air resistance slowed the ball down.

<パート 2 > (配点率 30 %)

Read the following passage and answer the questions that follow.

For most people shopping in America, it's unavoidable: Fast fashion is all over the place. Though definitions may vary, this large chunk of the clothing available today includes items made and shipped as cheaply and quickly as possible. And though fast fashion puts all the latest clothing trends in shopper's baskets right away, the speed and trendiness comes with environmental and ethical (①). "Depending on who you're talking to, they'll be more aware of one (②) over the other," says Christine Ekenga, an *environmental epidemiologist at Washington University in St. Louis.

And even for those who study the impacts fast fashion has, understanding exactly how much waste or environmental damage fast fashion creates is challenging. Brands and manufacturing facilities don't often have an (③) to be transparent about their practices, says Kamyar Shirvani Moghaddam, a *sustainability scientist at Deakin University in Australia. Companies hoping to make clothing as cheaply as possible for buyers in (④) countries *outsource much of the *textile production and treatment process to lower-income nations, particularly those with few manufacturing and labor laws.

Additionally, producers rely on (⑤) techniques to dye, fade, break down or mass-produce their items. When those techniques give companies a competitive retail edge, the organizations might consider them to be trade secrets and can (⑥) to share finer details about how much of what ingredients are needed.

Despite these roadblocks, researchers and industry investigations have assembled a picture of all the ways fast fashion causes environmental and health problems, from the very beginning of textile production to long after we've forgotten about the clothing we throw away.

Some of the most dominant textiles used in fast fashion are cotton and *synthetics like polyester. Cotton farming, which is water-intensive, requires *pesticides and *fertilizers, which runoff into rivers and lakes to create toxic (⑦) for wildlife. Meanwhile, polyester — which according to Greenpeace, is in about 60 percent of clothing made today — comes from the fossil fuel petroleum. Not only does the crude oil have to be extracted, but the polyester fibers are slow to (⑧) down in *landfills and are partially responsible for the *microplastics washing out into bodies of water. Recently, microplastics (⑨) up in 70 of 71 of sea water samples researchers pulled from the Arctic. Of the plastics found, over 67 percent was polyester fiber.

The treatments used to turn the fabrics into wearable items (⑩) to pollution, too. Clothing manufacturers use dyes, salts and other compounds to change fabric color and guarantee the color stays in place. The process often takes several rounds of washing — on average, one kilogram of textiles requires just over 200 liters of water. And though some manufacturers have begun reusing some wastewater for the repeated cycles, that's not always the case, says Shirvani Moghaddam, a sustainability scientist at Deakin University in Australia.

Locations where clothing manufacturing labor is cheapest also tend to be locations with low safety or occupational hazard standards. "In terms of environmental justice, these are industries that are notorious for poor workplace safety practices," says Ekenga. Employees, who are mostly women, are (⑪) to all the chemicals used in the manufacturing process — additives that wastewater analysis has shown to include *arsenic, chromium and zinc. Breathing in dust from cotton, flax or hemp, a problem *garment workers face, can lead to symptoms similar to asthma and the kind of lung inflammation smokers often deal with. Workers also cope with injuries on the job. One (⑫) in Ethiopia, for example, found that just over 40 percent of textile workers surveyed dealt with an injury in the past year, which was most often

caused by a machine that (⑬) their hands or eyes.

Despite the pollutants, greenhouse gases and labor going into fast fashion, the products only make brief (⑭) in our closets. The average American gets rid of 80 pounds of clothing each year, a figure that has grown in the last decade and a half. And though some estimate up to 95 percent of wasted clothing could be (⑮), over 65 percent of what Americans throw away winds up in landfills.

And though the plastic fibers, dyes, leather, metal parts and more sit in our own landfills, the U.S. also exports unwanted clothing. In 2015, we sent over $700 million dollars worth of clothing to lower-income nations. There, low-wage workers sort the clothing further, and what isn't wanted becomes a part of the (⑯) problem in those nations, too.

It's tempting to say that a solution to the problems of fast fashion is to opt-out entirely — just not buy clothing made this way. But that's not a solution for everyone. "We need to acknowledge that not everyone can (⑰) to pay more for their clothes," Ekenga says, though everyone can try to shop in moderation and be mindful of how much they (⑱).

Shoppers with the funds and capacity to sort through the brands they buy have to be wary, too. When brands try and discuss being "eco-friendly" and show ways they've reduced their *environmental footprint, reading the fine print can be revealing, Moghaddam says. He's seen some brand announcements in the past, for example, that claim massive improvement in (⑲) use. But upon a closer read, the reports only discussed power consumed in retail stores — not during production or transportation, where a majority of the pollution and energy consumption happens.

Some solutions to the harms of fast fashion have to come from brands and the manufacturers they hire. Clothing production innovations could ease damages as well. Recycling fibers — taking garments apart, re-dying them and putting them into new products — is an option, and requires more infrastructure

to make returning clothes just as easy as (⑳) them away, Moghaddam says. Manufacturing via 3D printing, where each item is made exactly as ordered, eliminates excess and waste material that gets cut away from garments, too.

Ultimately, Moghaddam says, "we need to rethink the materials and also the process."

Source (with changes) :

Nemo, L. (2021, June 26). How fast fashion harms the environment — and people's health. *Discover Magazine*. https://www.discovermagazine.com/environment/how-fast-fashion-harms-the-environment-and-peoples-health

Notes :

environmental epidemiologist : a person who studies how the environment affects human health

sustainability : using products and energy in a way that limits harm to the environment

outsource : to have work done outside the company, especially in foreign countries

textile : any type of cloth or fabric

synthetic : an artificial substance or material

pesticides : a chemical used for killing pests, especially insects

fertilizer : a substance added to soil to make plants grow more successfully

landfill : a large area of land where garbage and waste are buried

microplastics : extremely small pieces of plastic in the environment that come from human garbage and waste

arsenic, chromium, zinc : poisonous, harmful, or dangerous chemical elements

garment : clothing

environmental footprint : the effect on the environment

設問 1：**Use the following words to best complete the text. Use each word once. Use a capital letter if necessary.**

study	wealthier	energy	conditions
appearances	exposed	showed	waste
incentive	consume	aspect	break
throwing	afford	damaged	specific
recycled	hesitate	consequences	contribute

設問 2：**Answer the following questions in English in complete sentences and in your own words.**

1. According to the article, what is fast fashion and what are its broad effects on the environment and workers?

2. According to the article, how can the negative effects of fast fashion be reduced by individuals and fashion brand manufacturers?

<パート3>　　(配点率 30 %)

Please read the article below and answer these two questions in English.

Questions

1. How did Deblina Sarkar's parents influence her future as a researcher? Answer in approximately 50 words.
2. Please write a paragraph explaining why you would, or wouldn't, want a machine to be surgically implanted into your brain to make you smarter. Answer in 75 words or less.

Deblina Sarkar makes little machines, for which she has big dreams. The machines are so little, in fact, that they can inhabit living cells. And her dreams are so big, they may one day save your mind.

Sarkar is a nanotechnologist and assistant professor at MIT. She develops ultratiny electronic devices, some smaller than dust, that she hopes will one day enter the brain. Sarkar says, "I'm probably working day and night on my research because there is an urgent problem at hand."

That problem is Alzheimer's disease, Parkinson's disease and other *neurological afflictions that attack the minds of millions of people worldwide. Sarkar's solution: Use tiny machines to detect and reverse these disorders.

Born in Kolkata, India, Sarkar credits both of her parents as early inspirations. Her boldness as a researcher comes from her mother, who as a young woman defied social norms in her village by working to fund her own education and speaking out against the *dowry system. Meanwhile, Sarkar's father sparked her fascination for engineering.

At the age of 15, he abandoned his dreams of becoming an engineer to find other jobs; he needed to support his parents and the rest of his family after his father, an Indian freedom fighter, was shot in the leg and could no longer work.

Still, Sarkar recalls her father finding time for his passion, fashioning devices to make home life more convenient. These included an electricity-free washing machine and vehicles that could carry heavy loads down small local roads to their house. "That got me very, very interested in science and technology," Sarkar says. "Engineering specifically."

After earning a bachelor's degree in electrical engineering from the Indian Institute of Technology Dhanbad, Sarkar moved to California to study nanoelectronics at the University of California, Santa Barbara. There, she tested new ways to create nanodevices that could reduce the amount of power consumed by computers and other everyday electronics.

Along the way, Sarkar became fascinated with the brain, which she calls "the lowest energy computer". Her Nano-Cybernetic Biotrek group develops nanodevices that can interface with living cells, and "neuromorphic" computing devices, which have architectures inspired by the human brain and nervous system. She's essentially establishing a new field of science, at the intersection of nanoelectronics and biology.

One day, Sarkar hopes to insert nanodevices between human neurons to boost the computing speed of the fleshy processor already in our skulls. Our brains are remarkable, she says, but "we could be better than what we are."

Source (with changes) :

Ogasa, N. (2023, May 3). Deblina Sarkar is building microscopic machines to enter our brains. *Science News*. https://www.sciencenews.org/article/brain-machine-deblina-sarkar-scientists-to-watch

Notes :

neurological affliction : conditions that affect the nervous system

dowry : a payment by the bride's family to the groom or his family at the time of marriage