

I. Read the following article and answer the questions (1-10).

Decades ago, synthetic polymers became popular because they were cheap and durable. Now, scientists are creating material that self-destructs or breaks down for reuse on command.

1 Adam Feinberg had no sooner made a bright yellow thin sheet of plastic than he had to shred it into little pieces. He chose an “I”-shaped mold for the logo of the University of Illinois at Urbana-Champaign where he is a chemist. Then, he filled (A)it with the plastic bits and stuck it in a hot oven.

2 “I opened up the mold and there was this (B)beautiful yellow ‘I,’” he recalls. (C)His new plastic passed the first test — it was moldable with heat like regular plastic. But there was another important step left in rethinking the world of durable plastics. Dr. Feinberg placed the ‘I’ under a white light, and five minutes later, only half of it remained. The plastic did not simply melt. Its building blocks, the synthetic polymers within, had reverted to their molecular units. “It was a phenomenal feeling,” he said of the successful experiment.

3 Most synthetic polymers — Greek for “many parts,” because they are long chains of many identical molecules — were not designed to disintegrate or disappear. On the contrary, they were meant to last as long as possible once they began replacing metals and glass in long-lasting things like automobiles and airplanes. But synthetic polymers became so popular and adaptable that decades later, they’re at the root of the global burden of billions of tons of plastic waste. Over the past few decades, this mismatch between material and product life span has built up plastic waste in landfills and natural environments, some drifting in oceans until mounds and mounds have reached the ends of the world and bits have been ingested by marine life. Too little gets recycled; in fact some estimates indicate that a mere 10 percent of all plastics are recycled every year.

4 The environmental effects of plastic buildup and the declining popularity of plastics have helped (D)to spur chemists on a quest to make new materials with two conflicting requirements: They must be durable, but degradable on command. In short, scientists are in search of polymers or plastics with a built-in self-destruct mechanism. “The real trick is to make them stable when you’re using them, and unstable when you don’t want to use them. They should not last forever,” says Marc Hillmyer, who leads the Center for Sustainable Polymers at the University of Minnesota.

5 The starting point requires picking polymers that are inherently unstable, and often historically overlooked because of their fragility. (E)Given a choice, their units would rather stay as small molecules. What scientists do is force those molecules to link up into long chains, and then trap the resulting polymers. Dismantling these polymers is sometimes called unzipping them, because once the

polymers encounter a trigger that removes those traps, their units fall off one after another until the polymers have completely switched back to small molecules.

1. What does the underlined word **(A)** refer to?

- a. a sheet of plastic
- b. the logo
- c. the mold
- d. the university

2. What was the “beautiful yellow ‘I’” in **(B)** made of?

- a. artificial coloring
- b. fragile glass
- c. plastic bits
- d. precious metals

3. Dr. Feinberg’s new material passed the first test, as stated in **(C)**. What does that mean?

- a. It became more durable than regular plastic.
- b. It became resistant to heat.
- c. It produced a beautiful yellow glow.
- d. When it was heated, its shape changed.

4. According to paragraph [2], what happened after the yellow plastic ‘I’ was exposed to a white light?

- a. Half of it changed its structure.
- b. It completely disappeared.
- c. Its color simply changed.
- d. It was immediately recycled.

5. Which of the following is NOT mentioned in paragraph [3]?

- a. Marine life is affected by plastic waste.
- b. Plastics were made to be long-lasting replacements for other materials.
- c. Products made of plastic last as long as the material itself.
- d. There is a lot of plastic in landfills and natural environments.

6. According to paragraph [3], which of the following is inferred about the author's opinion?
- a. Plastics are popular and unproblematic.
 - b. Plastics are the best replacement for other materials.
 - c. Plastics are the cause of pollution.
 - d. Plastics are the most economical material in the world.
7. According to paragraph [3], which of the following is true?
- a. About 10 percent of all plastics are not recycled.
 - b. Less than 10 percent of all plastics are not recycled.
 - c. More than 10 percent of all plastics are recycled.
 - d. Only 10 percent of all plastics are recycled.
8. Which of the following is closest in meaning to "spur" in (D)?
- a. discourage
 - b. encourage
 - c. punish
 - d. respect
9. Which of the following does the author mention in paragraph [5]?
- a. Easily broken polymers have long been ignored.
 - b. Scientists have chosen not to make stable polymers.
 - c. Scientists were not able to produce fragile polymers in the past.
 - d. Unstable polymers were not easy to find in the past.
10. Which of the following would be the most appropriate title for this article?
- a. Bright Future for Synthetic Polymers
 - b. Last Plastics to be Designed
 - c. Plastics Designed Not to Last
 - d. Synthetic Polymers Never Last Long

次の問題 [1], [2] の解答は記述式解答用紙に記入しなさい。

[1] Translate the underlined part (E) in the article into Japanese.

[2] Do you agree or disagree with the following statement?

“Shops should completely stop providing customers with plastic shopping bags.”

Write your own ORIGINAL reason in English within 25 words.

Answers over 25 words will not be considered.

Do NOT copy sentences or phrases from the article.

解答用紙の **because** 以降を 25 語以内で書き、使用語数を明記すること。

II. In each of the following passages (11-13), insert the underlined sentence(s) into the most appropriate position from (a) to (d).

11.

Now, their new research in the journal *Biology Letters* indicates that the pitch of babies' cries at 4 months old may predict the pitch of their speech at age 5.

In the Wails of a 4-month-old, the Intonations of a Much Older Self

The next time you hear a baby cry, take a good listen. It might tell you something about how its voice will sound decades later as an adult. (a)

Research has already shown that the pitch of a person's voice stays basically the same during adulthood and that how we sound as adults may be determined before puberty. (b)

A recent study indicated that the pitch of a boy's voice at age 7 can mostly predict what he will sound like as an adult. (c)

So when do our voices start emerging? One group of researchers hypothesized that differences in pitch would emerge very early—even in babies who haven't yet learned how to speak. (d)

In fact, the researchers said, the differences identifiable in babies' whines can explain 41 percent of the differences in voice pitch that appear by age 5.

12.

This new information confirms that penguins are among the most extraordinary vertebrate swimmers on the planet.

New Zealand's Penguin Migration Mystery

Each December, penguins with long blond eyebrows swim away from the shores of New Zealand for a two-month marathon swim halfway to Antarctica and back. The breathtaking distance has been recorded by researchers, who for the first time managed to track the birds.

Penguins, universally adored and the stars of cartoons, are actually not well studied. One third of all penguin species live in New Zealand, where they are part of the landscape, mostly in the wilder south. Nevertheless, most penguin species are considered vulnerable or endangered. **(a)**

Until now it was unclear where one penguin species — the Fiordland crested penguin (*Eudyptes pachyrhynchus*) — migrated each year in search of food. Zoologists assumed that they stayed near the coast. To find out, researchers with the Tawaki Project — which uses the bird's local name — attached satellite tracking tags to 20 penguins and followed their migration daily. **(b)**

“My first reaction was there's something wrong with the data,” said Thomas Mattern, a research fellow in the Department of Zoology, University of Otago, New Zealand and the project director. “Then I was just puzzled — where are they going, when will they stop?” **(c)**

The penguins swam halfway to Antarctica, in areas where the warm northern waters collide with the cold waters of the south. Then they swam back to New Zealand. Round trip, a female traveled 6,801 km (4,226 miles) in 67 days. A male swam 5,597 km (3,478 miles) in 77 days. The complete data relate to only five animals, because the tags seem to have detached from the 15 others being tracked during their trip. **(d)**

13.

That they could also have been used to signal aggression or intimidate competitors was largely dismissed as an evolutionary perk, as were the more expressive brows of modern humans.

Brow Ridges Evolved as a Communication Tool, not as a Chewing Aid, Researchers Find

Eyebrows have become a new fashion obsession, tattooed or microbladed, shaped and drawn in bold dark lines. (a)

Lifting one and not the other often signals disbelief, amusement, curiosity. Raising both can suggest surprise or dismay. But early humans had thick, bony brow ridges that were far less nimble than ours. (b)

Scientists have long thought those brows served some structural purpose, like support for chewing prehistoric food. (c)

But research by two anthropologists, Ricardo Miguel Godinho and Penny Spikins, published April 9 in *Nature Ecology & Evolution*, suggests that the human brow has always been primarily a social tool, and that the smoother foreheads and expressive brows of modern humans may have evolved to accommodate increasingly complex relationships.

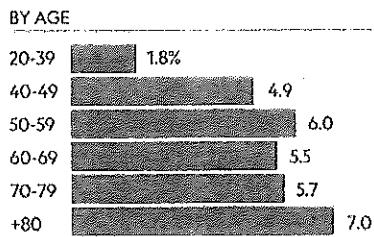
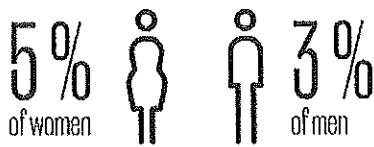
“With a flatter, more vertical forehead, that whole area above the eyes becomes much more mobile, and the muscles can make some really subtle communicative gestures,” Dr. Spikins said. (d)

III. Based on the graphs below, choose the most appropriate answer to fill in each blank (14-23).

Americans today are not getting enough sleep. This is chiefly due to the proliferation of electric lights, followed by televisions, computers, and smartphones.

According to the U.S. Centers for Disease Control and Prevention, more than 80 million American adults are chronically sleep deprived. They sleep (14) the recommended minimum of seven hours a night. Insomnia is the main reason four percent of U.S. adults take sleeping pills in any given month. Insomniacs generally take longer to fall asleep, wake up for prolonged periods during the night, or both.

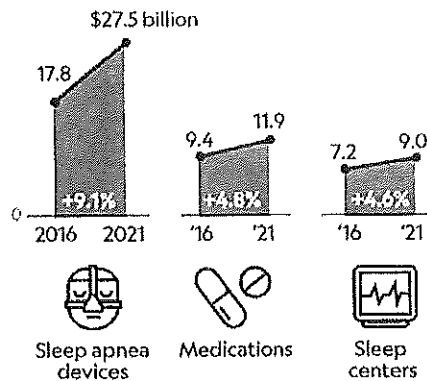
THE AGE OF SLEEP AIDS



The elderly are more likely to use prescription sleep aids than their younger counterparts. (15) percent of people over 80 years of age reported using such sleep aids. However, the second largest age group that reported using prescription sleep aids are people in their (16). Overall, women are slightly more likely than men to report they used sleep aids: the difference is (17) percent.

THE MARKET FOR SLEEP

Sleep-deprived consumers paid \$66 billion in 2016 for devices, medications, and sleep studies. The figure could rise to \$85 billion by 2021.



In 2016, sleep deprived consumers in the United States of America spent a little over \$9 billion on medications, (18) the amount of money spent on sleep apnea devices was close to \$18 billion. It is expected that the amount of money spent on sleep apnea devices will rise to \$ (19) billion by 2021. The amount spent in sleep centers might increase to \$9 billion. Compared to the amount of money spent on the other main categories of sleep aids, this increase will be the (20).

THE COST OF SLEEPLESSNESS

A 2017 Rand study found that lack of sleep can result in reduced productivity as well as more work absences, industrial and road accidents, health care expenses, and medical errors.

	Billion \$/year	% GDP lost
United States	\$411 billion	2.28%
Japan	\$138.6	2.92%
Germany	\$60	1.56%
United Kingdom	\$50.2	1.86%
Canada	\$21.4	1.35%

NGM STAFF. SOURCES: U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION; BCC RESEARCH; RAND EUROPE

Insufficient sleep is a problem not only in the United States of America. Economies of many developed countries suffer because of sleeplessness. Increases in accidents, medical errors, health care expenses, and people missing work are all caused by lack of sleep. Economic losses are measured in billions of dollars annually. In 2017, for example, (21) suffered the highest losses of its GDP. This was solely (22) the sleeplessness-caused problems. Because of its large economy, (23) sustained the largest losses measured in over \$400 billion.

- | | | | | |
|-----|-----------------|------------------|-----------------------|----------------------|
| 14. | a. as much as | b. at least | c. less than | d. more than |
| 15. | a. 5.7 | b. 6.0 | c. 7.0 | d. 12.7 |
| 16. | a. 40s | b. 50s | c. 60s | d. 70s |
| 17. | a. less than 2 | b. 2 | c. 3 | d. about 5 |
| 18. | a. as far as | b. because | c. so | d. whereas |
| 19. | a. 9.7 | b. 11.9 | c. 17.8 | d. 27.5 |
| 20. | a. biggest | b. most dramatic | c. most unanticipated | d. smallest |
| 21. | a. Canada | b. Germany | c. Japan | d. the United States |
| 22. | a. according to | b. due to | c. henceforth | d. hereinafter |
| 23. | a. Germany | b. Japan | c. the United Kingdom | d. the United States |

IV. Based on the following dialog and the image from the manual below, answer the questions (24-34).

Shion: Hi, Cameron. What a surprise! (A) Long time no see!

Cameron: (B) Oh, look who it is! ... My dear friend, you look great!

Shion: Thanks! Actually, I've taken up yoga again and I've started jogging. I run a few kilometers every morning. But, (C) you're in great shape, too!

Cameron: Well, I've started going to the gym. By the way, I've also started a scuba diving course! I'm taking lessons on the weekends, in Kanagawa.

Shion: (D)

Cameron: Oh, and I have an awesome dive instructor from Malaysia. I'll be visiting his country after I finish the course.

Shion: You know, I'm a passionate diver, too. And, my favorite dive spots are in Malaysia!

Cameron: Yeah, I remember how you talked about your amazing dive trips. Hmm, maybe you could give me a piece of advice?

Shion: Sure!

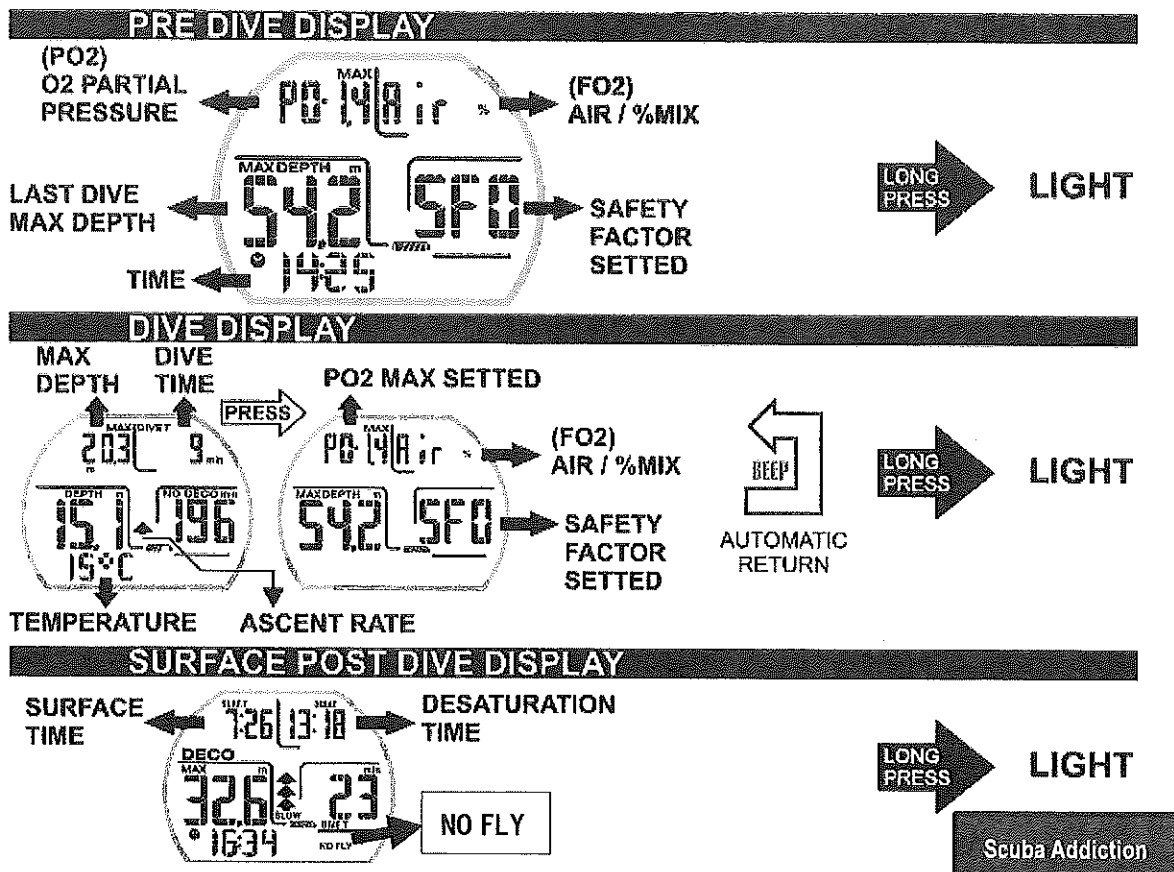
Cameron: I got a new dive computer as a present from my partner, but I'm not sure how to read the display.

Shion: What kind of computer did (E) he pick for you?

Cameron: The newest type from the Scuba Addiction series. This one [*showing a picture in her smartphone*].

Shion: (F) Oh, what a coincidence! Just like mine! Scuba Addiction, Pro Generation II. That's a great one!

Cameron: Thanks! So... here's what I don't understand. See page 5 in the manual? [*showing her smartphone screen to Shion again—see the image below*]



Shion: Uh-huh.

Cameron: The figure in the middle... What happens after I quickly press the button once, while I'm diving?

Shion: Well, as you know, that figure in the middle is your **(G)** display.

Cameron: Yes. It activates automatically when I'm underwater. Umm...when I reach 2-3 meters below the surface!

Shion: That's right. As you can see, it shows the maximum depth you dived, your dive time, and other things. Oh, and you can also check your **(H)** ascent rate...

Cameron: Got it, thanks! But, what happens if I press the button briefly?

Shion: If you press the button briefly, the display will change for a short period of time. For a few seconds, I think.

Cameron: Change like in the second image, on the right?

Shion: Yes. You will see different values after you press the button. But, after a few seconds, you will hear a beeping sound. Then, the original display automatically shows again.

Cameron: Like the original display on the left?

Shion: That's right. **(I)** That's what you'll *always* see when you're underwater, if you don't press the button.

Cameron: Oh, OK, thanks! And what happens if I'm still diving and keep pressing the button for a couple of seconds, not just once briefly?

Shion: In that case, **(J)**. Just like you see on the right side of the diagram, where it says "long press."

Cameron: So, is that the same for the pre dive and post dive display as well, not just when I'm underwater?

Shion: Yes, that's right.

Cameron: I see.

Shion: Don't forget to check your post dive display to know when you can fly!

Cameron: Oh, yes, I remember! I can't ride an airplane as long as the display reads "NO FLY" in the right bottom corner.

Shion: Yes. "NO FLY" means "Don't fly."

Cameron: Thanks, Shion, for reviewing this with me. It's really helpful.

Shion: **(K)**

24. Which of the following is closest in meaning to the underlined expression **(A)**?

- Cameron and Shion have not met for a long time.
- Cameron's eyesight has worsened over time.
- Shion has not seen her friends much lately.
- Shion's eyesight has been very poor.

25. Cameron says **(B)** because she

- cannot recall who Shion is.
- is pleasantly surprised to see Shion.
- thinks Shion has not changed since they last met.
- wants to introduce Shion to another friend.

26. The underlined expression (C) means that Cameron
- has nice make-up and hairstyle.
 - is wearing nice clothes and jewelry.
 - looks happy and cheerful.
 - looks healthy and fit.
27. Choose the most appropriate expression to fill in (D).
- Don't mention it!
 - Good for you!
 - It's my pleasure!
 - What's up?
28. Who does the underlined word (E) refer to?
- Cameron's partner
 - Shion's boyfriend
 - the dive instructor
 - the seller who sold the computer
29. Why is Shion saying (F)?
- She has the same smartphone as Cameron.
 - She has the same type of dive computer.
 - She likes her own smartphone.
 - She likes her partner's dive computer.
30. Choose the most appropriate expression to fill in (G).
- dive
 - dive game
 - pre dive
 - surface post dive
31. What does the underlined expression (H) mean?
- how fast the diver is going down
 - how fast the diver is rising
 - the amount of oxygen used per minute
 - the average depth dived

32. What does the underlined word **(I)** refer to?
- a. the "NO FLY" warning
 - b. the original display
 - c. the post dive display
 - d. the second image
33. Choose the most appropriate expression to fill in **(J)**.
- a. the beeping sound continues
 - b. the computer turns off
 - c. the light turns off
 - d. the light turns on
34. Choose the most appropriate expression to fill in **(K)**.
- a. Glad I could help!
 - b. I hope I can help!
 - c. I owe you!
 - d. Looking forward!