

Lesson 11 Plenty of Room at the Bottom (pp.166-177) 練習問題

New technology changes our lives. The 19th century was transformed by the steam engine, electricity and the telegraph; the 20th century was transformed by radio and TV, automobiles and airplanes, computers, and nuclear power. What new technology will most affect our lives in the 21st century? Many scientists believe the answer to that question is “nanotechnology.”

① On December 29, 1959, Richard P. Feynman, a Nobel Prize winner in physics, made an epoch-making speech, the title of (①) was “There’s Plenty of Room at the Bottom.” In his speech, Feynman speculated on the possibility of exploring the world that exists “down at the bottom,” i.e., the world of atoms and molecules. He cautioned that he was not talking about miniaturization of, say, electric motors that are the size of the nail on your little finger, but rather a “staggeringly small world that is below.” He further predicted that in the future we would be able to make machines as small as molecules.

② Feynman’s ideas seemed strange at the time he made his speech in 1959, but today he is thought to be the father of nanotechnology, which is on the cutting edge of modern science. What is nanotechnology? What impact will it have on our lives?

③ The word “nanotechnology” is composed of two parts: “nano,” meaning “dwarf” in Greek, and “technology.” So you may safely assume that it has to do with some kind of technology dealing with something (②). Then how small is “nano”? In mathematical terms, “nano” denotes one-billionth (i.e., ten to the minus power of nine). In other words, one “nanometer” is one-billionth of a meter, roughly the ③wide of five carbon atoms, or a single sugar molecule. It might help visualize the image of its size if we say that one nanometer and one meter are approximately in the same proportion as the diameter of a ping-pong ball to that of Earth. The ③wide of the average human hair is about 80,000 nanometers.

④ Now you probably have a sense of the nano-scale, but what exactly is nanotechnology? As for the definition of the term, suffice it to say that* it is the technology of creating various devices and products by manipulating single atoms and molecules.

⑤ In fact, Feynman proposed the idea of making an extremely small robot which would be capable of making copies of itself, but only smaller (④) size. Then the second-generation robots would make copies of themselves even smaller, and so on down the line until you have trillions of nanorobots working to build complex products quickly. Following Feynman, K. Erik Drexler, the author of *Engines of Creation: the Coming Era of Nanotechnology*, proposed the idea of a “nano-assembler,” a device which would manipulate atoms and molecules to produce desired products.

6 What could we build? We might possibly be able to build a supercomputer no bigger than a human cell but billions of times faster than anything we have today. Eventually, we might also be able to create medical nanorobots which would move inside our bodies to search out viruses and cancer cells and (5) them. Those tiny robots in the body could provide “pinpoint drug delivery,” putting drugs just where they are needed without harmful side effects.

7 ⑥Another possibility is to make an extremely small storage system which can store all the information contained in an entire library. In his speech, Feynman speculated as follows: “What would our librarian say, as she runs all over from one building to another, if I tell her that all of the information that she is struggling to keep track of — 120,000 volumes, stacked from the floor to the ceiling, drawers full of cards, storage rooms full of the older books — can be kept on just one library card! When the University of Brazil, for example, finds that their library is burned, we can send them a copy of every book in our library by making a copy from the master plate and mailing it in an envelope no bigger or heavier than any other ordinary air mail letter.”

8 At present, we have not quite reached the level of technology where we can realize all the visions and dreams put forward by Feynman in his speech. However, this is no reason for us to become ⑦pessimistic about the future of nanotechnology. Remember that at the beginning of the 20th century manned flight was little more than* a dream and nobody had even heard of plastics. What is just a dream today could be reality in a generation or two. Products of nanotechnology could be just as common as ballpoint pens, microwave ovens and DVD players in the future.

9 Nearly half a century has passed since Feynman made his speech, and we are beginning to make part of his dream come true. For one thing, it is now possible to spell words by manipulating individual atoms with the help of an electron microscope as you can see in photos (1) and (2) below:

※图省略

10 The entire logo in photo (1) is only about 400 nanometers wide. Although atomic words may have no practical benefit for our lives, they are important in the sense that they show what can be done with nanotechnology. In other words, we have taken the first steps toward Feynman’s vision of making a library card that can contain all the data stored in a library, or of making complex products atom by atom.

11 What we can do now is still limited, but the result of mastering this technology could change our lives and our society beyond anything we can imagine today. We might be able to

solve environmental problems such as global warming and air pollution. We might also be able to enjoy a much longer life span without suffering from serious illnesses like cancer. It would seem, therefore, that nanotechnology offers the promise of a happy future, but we have to be aware of the fact that, as with any new technology, there may be dangers. Even Drexler, a strong supporter of nanotechnology, has some reservations:

There are many people, including myself, who are quite queasy about the consequences of this technology for the future. We are talking about changing so many things that the risk of society handling it poorly through lack of preparation is very large.

12 In fact, ⑧ nanorobots capable of making copies of themselves might accidentally create artificial organisms which could reproduce and change very quickly, beyond human control. Nanorobots could also be used as weapons which would be even more difficult to control than nuclear, chemical and biological weapons are today. In addition, nanotechnology may be combined with genetic engineering to create human clones, which poses some ethical problems.

13 While recognizing these possible problems and dangers associated (⑨) nanotechnology, we should not let our fears of new technologies ⑩(deprive) us of their potential benefits which we might enjoy by exploring the unknown. After all, as Feynman pointed out, there's plenty of room at the bottom.

〔語注〕 suffice it to say that ~* : ~といえは十分である little more than ~ : ~と大差ない

【問題】

1. 空所①に入る最適な語を以下のア～エの中から選びなさい。
ア that イ whose ウ whom エ which
2. 空所②に入る最適な語を以下のア～エの中から選びなさい。
ア large イ much ウ tiny エ medium
3. 下線部③の語を適切な形に変化させなさい。
4. 空所④⑨に入る最適な前置詞を答えなさい。
5. 空所⑤に入るのに最適な動詞を以下のア～エから選びなさい。
ア preserve イ help ウ destroy エ increase
6. 下線部⑥Another possibility とは何か。解答欄に合うように日本語で答えなさい。
7. 下線部⑦pessimistic の反対語を答えなさい。
8. 下線部⑧はナノテクノロジーの危険について述べています。下線部以外にも 2 つの危険性について述べられていますが、それを日本語で説明しなさい。
9. 下線部⑩の語を適切な形に変化させなさい。変化させる必要がない場合は原形を書くこと。

10. 次の各文が本文の内容と一致していれば T, 一致していなければ F と答えなさい。
- (1) Feynman told his audience to be reminded of miniaturization in order to let them understand his theory.
 - (2) Feynman's idea was admired by a lot of people just after it was released.
 - (3) The word "nano" comes from Greek.
 - (4) A "nano-assembler" is capable of making copies of an extremely small robot.
 - (5) Nanorobots are expected to make a great contribution to medical treatment.
 - (6) Nanotechnology will enable librarians to spend much less time keeping track of their books in a library.
 - (7) A library in Brazil succeeded in developing a nano-card that is capable of storing all the information of the books it has.
 - (8) Nanotechnology is to be abolished because what is just a dream today could be reality in a generation or two.
 - (9) Just as any new technology can be dangerous, nanotechnology should also be skillfully handled.
 - (10) Nanorobots can become dangerous weapons because they can attack human beings anywhere.