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請勿在本試題紙上作答，否則不予計分

I. Vocabulary (30 points)

Select a word or a definition which has the closest meaning to that of the underlined word in each sentence.

1. She knows how to manipulate the machine.
a) disassemble b) start c) stop d) control
2. The trajectory of the particle can be predicted by the equation.
a) path b) mass c) momentum d) velocity
3. There are few legal constraints on the sale of firearms in the U.S.
a) legislation b) organizations c) restraints d) retailers
4. The system was in equilibrium.
a) an unstable condition b) a critical state c) trouble d) a state of balance
5. The data show spontaneous emission of light from atoms.
a) intense b) weak c) artificial d) self-generated
6. We share a collective responsibility to mitigate the social impact of the crisis.
a) lessen b) enhance c) announce d) ignore
7. The particles are confined in the chamber.
a) layered b) frozen c) trapped d) separated
8. The electromagnetic waves stimulate the molecule.
a) excite b) propagate c) create d) terminate
9. Fluctuation in the pressure was induced by the surrounding condition.
a) Saturation b) decrease c) increase d) variation
10. Thermal diffuse scattering gives rise to an anomalous absorption.
a) abnormal b) fine scale c) remarkable d) clear
11. His first and second reports contradict each other.
a) are consistent b) complement each other c) are a series of articles d) do not hang together
12. The educational system is in transition.
a) difficulty b) impasse c) phase of change d) problem
13. They carried out the plan.
a) made b) executed c) put off d) canceled
14. The noise may disorient the satellite.
a) diagnose b) destroy c) guide d) cause to be lost
15. Filaments of plasma erupt from the surface.
a) burst b) inject c) collapse d) disappear

(背面仍有題目,請繼續作答)

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II. Reading comprehension (50 points):

Read the passages extracted from the article "A crisis of perception" written by Allen O. Scheie (published in Physics Today, August 13 2013) below and answer the questions that follow. (Explanations for the words * are given in the footnote)

The public believes that science is all about developing technology. What does this mean for science ?

I recently had an interesting conversation with an executive engineer from a spaceflight company. Our conversation began with satellites and rockets but soon came around to the Higgs boson discovery at CERN*¹. With a concerned expression, he bluntly told me he did not understand why anybody would spend billions of dollars just (i) to see a tiny particle that exists only for an instant.

I was taken aback. Here was a man who (A) _____ his whole life as an engineer—surely he should appreciate the value of scientific discovery, especially something as fundamental as the explanation for mass. Apparently, he did not.

That attitude seems increasingly common today. Traditionally, the goal of science has been elucidating nature and discovering its laws. However, the public now seems to view science's primary goal as developing technology and creating products.

snip

Science-policy people usually talk about two types of research: basic and applied. Basic research is conducted to investigate nature, whereas applied research is conducted to develop a specific technology or product. Although the line separating the two is often fuzzy, companies and governments usually differentiate between them for budgeting purposes. Historically, strong funding has been allocated for both. However, under the mindset that science is about "making the world a better place," inquiry would be valuable only if it eventually led to new technologies. When funding is limited, as in recent years, it will flow to research that yields direct, timely results. What manufacturer (B) _____ Albert Einstein to develop special relativity ?

Basic research, although it can be an expensive and uncertain undertaking, is the foundation for all future applied R&D*². If we do not conduct basic research today, there will be no applied research tomorrow. And basic research needs funding.

snip

*¹ The Higgs boson or Higgs particle is an elementary particle predicted almost 50 years ago to exist by the Standard Model of particle physics. In 2012, the discovery of a new particle was reported which might be the Higgs boson in the Large Hadron Collider at CERN [Conseil Européen pour la Recherche Nucléaire (European Organization for Nuclear Research)].

*² Research and development

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Fortunately, the mindset that "(C)science is about technological advancement" has not yet infiltrated^{*3} the scientific community. Most scientists still understand that science is really about discovery. It is vital, however, that we pay attention to what the public thinks. The public's perception of science will define the direction of the discipline, for two reasons.

First, public perception determines where the money goes. Corporations and governments fund research based on what they think its purpose is. We see that happening today. The Research Council of the UK lists its priorities for scientific research in terms of economic and social benefits. Likewise, China recently announced that its focus for scientific research will be on "translating research into technologies that can power economic growth and address pressing national needs." Any purely basic research will be hard to defend or initiate under such paradigms.

snip

The second reason public perception is so important is that the applied-first mindset will eventually seep^{*4} into science itself. Whereas today's scientists might still believe in the quest for understanding, tomorrow's scientists will grow up in a world that tells them that science is about delivering more tangible benefits to society.

snip

In an age of satellites, laptops, and smartphones, one can easily be swept away by the amazing technology that results from scientific research. We must not lose sight, however, of science's foundation: inquisitiveness about creation. Science teachers, researchers, and science writers must take advantage of that foundation and explain to the public the value in the quest for understanding, the thrill of discovery, and the incredible privilege of searching for the secrets of the universe.

So how did I respond to the spaceflight engineer who said the Large Hadron Collider was a waste of money? I replied that the goal of the experiment was not just to see a flash of a particle. It was to explain mass—one of the most fundamental yet mysterious aspects of our world. Whether or not the Higgs discovery yields technological advances, we are a step closer to understanding the vast and mysterious workings of the cosmos. I do not know if I convinced him, but I hope I gave him a taste of what the scientific endeavor really is.

End of the article

^{*3} become widespread

^{*4} spread

(背面仍有題目,請繼續作答)

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Questions:

1. Fill in the blank (A) with the most suitable words from a)- d) to complete the sentence. (4 points)
a) spend b) spent c) will spent d) had spent
2. Fill in the blank (B) with the most suitable words from a)- d) to complete the sentence. (4 points)
a) pay b) paid c) would have paid d) will pay
3. What type of research do decision makers and public of today prefer? Answer to this question with the most appropriate one word from the article. The word is expected to be connected to "research". (4 points)
4. What does the sentence underlined (C) mean? Choose the most suitable answer from a)-d). (4 points)
a) Science is about looking for a law of nature. b) Science is about making the world a better place. c) Science is about earning much money. d) Science is about seeking funding.
5. What does the author state science teachers, writers and researchers should take advantage of to explain the value of basic research to public? Select the most suitable words from the list given below. (5 points)
(a) curiosity about creation, (b) satellites, laptops, and smartphones, (c) amazing technology, (d) the secrets of the universe
6. What is the goal of the experiment that the underlined part (i) mentions? Describe it by filling in the blank of the following sentence with a few words along the line of the author's idea written in this article. (5 points)
The goal of the experiment is to [].
7. Why does public perception matter? Give the reasons along the line of the author's idea written in this article. (within 30 words) (8 points)
8. Why is basic science research important? Answer to this question by filling the blanks of the sentence below with the most appropriate words within those used in the article.
One of the reason why basic research is important is that it is the basis for future [] research and []. (4 points each)
9. Composition: Describe your opinion about what the public view on science in Taiwan is. (within 30 words) (8 points)

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III. Scientific description (20 points)

- (1) From the curves (A, B, C and D) in Figure 1, choose a curve consistent with each explanation shown below. (Each 4 points)
- It is inversely proportional to x .
 - It is symmetric about the y axis (*not shown*).
 - It approaches asymptotically to zero as absolute value of x becomes larger.
 - Its y -intercept is not zero and not infinity.

- (2) What is the coordinate (x, y) of the intersection of curves A with C and D? (4 points)

