

系所組別： 太空天文與電漿科學研究所

考試科目： 科學英文

考試日期：0219，節次：1

※ 考生請注意：本試題 可 不可 使用計算機**Part I: Synonyms (30% total, 2% for each question)****Make the choice that has the closest meaning to the underlined word, term or phrase.**

1. Light can reveal colors of objects. It can also distort them.
(A) highlight (B) accentuate (C) hide (D) deform
2. The strong colors, geometric patterns and distinct visual symbolism make most national flags, even when miniaturized, instantly recognizable.
(A) made brighter (B) made darker (C) made larger (D) made smaller
3. Many environmentalists do not support the outright banning of pesticides. Rather, they object to indiscriminate use --- use without any thought for caution and moderation.
(A) illegal (B) ineffective (C) uncontrolled (D) unbiased
4. The United States has an immense domestic market and the highest per capita consumption of goods in the world. The country depends mainly on trade within its national borders.
(A) successful (B) important (C) prominent (D) massive
5. A wide range of fonts is available on personal computers. Their number is far greater than that of conventional printing processes.
(A) traditional (B) new (C) restricted (D) competing
6. The cotton gin, invented by Eli Whitney in 1793, was commonplace on many nineteenth-century farms.
(A) standard (B) celebrated (C) refined (D) outdated
7. The geologic history of the Earth reveals a lot of information about the evolution of the continents, oceans, atmosphere, and biosphere.
(A) traces (B) teaches (C) discloses (D) donates
8. Because weather constitutes a major element of the environment and an important factor in human well-being and activity, one of the humanity's oldest environmental-related interests has been to manage the weather purposefully.
(A) deliberately (B) exceedingly (C) constantly (D) prosperously
9. Scientists in the field of artificial intelligence are studying methods for developing computer programs that display aspects of intelligent behavior.
(A) narrate (B) exhibit (C) declare (D) arrange
10. No deep understanding of the Solar System can be achieved without a knowledge of the fundamental properties of the Sun.
(A) proper (B) adequate (C) thorough (D) enduring
11. Volatile gases and liquids near and above the surface of the Earth are of prime importance to maintaining life on Earth.
(A) superficial (B) chief (C) dubious (D) dramatic
12. Engineering geologists determine whether the geological structure of a location is suitable for the building of huge structures such as dams.
(A) recoverable (B) extensive (C) perfect (D) appropriate
13. NASA is confident that the spacecraft it launches are fundamentally sound and perfect safe.
(A) equipped with electronic music (B) basically well designed and built
(C) dangerously old and worn (D) entirely new and experimental

(背面仍有題目,請繼續作答)

系所組別： 太空天文與電漿科學研究所

考試科目： 科學英文

考試日期：0219，節次：1

※ 考生請注意：本試題 可 不可 使用計算機

14. The Netherlands is the most densely populated country in the European Union.
(A) the largest number of people living in the countryside
(B) population is the largest
(C) population per square kilometer is the largest
(D) has the largest city
15. The invention of the airplane was a crushing blow for advocates of hot air ballooning.
(A) kept ballooning from becoming more popular
(B) promoted hot air ballooning internationally
(C) caused hot air balloons to leak air
(D) led directly to the improvement of hot air balloons

Part II: Reading Comprehension (40% total, 5% for each question)

Read the following article from *Nature* (published online October 2, 2009) and answer Questions 16~23 in simple English words.

Artificial ionosphere creates bullseye in the sky

Auroral experiments make glowing plasma patch.

by Naomi Lubick

An experiment that fires powerful radio waves into the sky has created a patch of 'artificial ionosphere', mimicking the uppermost portion of Earth's atmosphere. The research has not only caused glowing dots to appear around these patches — it could also provide a new way to bounce radio signals around the globe.

The High Frequency Active Auroral Research Program (HAARP), near Gakona, Alaska, has spent nearly two decades using radio waves to probe Earth's magnetic field and ionosphere. One of the most obvious results of the experiments is that they can create lights in the sky that are similar to auroras, the glowing curtains of light that naturally appear in the polar skies when electrons and other charged particles pour down from Earth's protective magnetosphere into the upper atmosphere. There, at an altitude of about 250 kilometres, the charged particles collide with molecules of oxygen and nitrogen and make them emit light, similar to the process inside a fluorescent light bulb.

HAARP's high-frequency radio waves can accelerate electrons in the atmosphere, increasing the energy of their collisions and creating a glow. The technique has previously triggered speckles of light while running at a power of almost 1 megawatt¹. But since the facility ramped up to 3.6 megawatts — roughly three times more than a typical broadcast radio transmitter — it has created full-scale artificial auroras that are visible to the naked eye.

Bullseye!

But in February last year, HAARP managed to induce a strange bullseye pattern in the night sky. Instead of the expected fuzzy, doughnut-shaped blob, surprising irregular luminescent bands radiated out from the centre of the bullseye, says Todd Pedersen, a research physicist at the US Air Force Research Laboratory in Massachusetts, who leads the team that ran the experiment at HAARP.

The team modelled how the energy sent skywards from the HAARP antenna array would trigger these odd shapes. They determined that the areas of the bullseye with strange light patterns were in regions of denser, partially ionized gas in the atmosphere, as measured by ground-based high-frequency radar used to track the ionosphere².

系所組別： 太空天文與電漿科學研究所

考試科目： 科學英文

考試日期：0219，節次：1

※ 考生請注意：本試題 可 不可 使用計算機

The scientists believe that these dense patches of plasma could be gas that was ionized by the HAARP emissions. "This is the really exciting part — we've made a little artificial piece of ionosphere," Pedersen says.

"The novelty is not seeing the aurora — it's the fact that we can actually create enough high-energy electrons to form plasma," says Mike Kosch, chair of Experimental Space Science at Lancaster University, UK, and a former co-worker of Pedersen's who was not involved in the experiment. "It shows something completely different and new that we hadn't expected. We didn't know we could do that from a radio array on the ground."

The team's results are published in *Geophysical Research Letters*².

Power up

HAARP's success is down to the fact that it operates at much higher power than any other array running similar experiments, such as the EISCAT (European Incoherent Scatter) Scientific Association's antenna in Norway, which runs at 1.2 megawatts, explains Kosch.

"Whether it's useful or not is another story," he adds, joking that companies might one day hire physicists to use the technology to write glowing advertisements in the night sky. But the costs would be astronomical to create artificial aurora that are visible, he says — the energy costs of running HAARP at full power are more than US\$4,000 an hour.

More serious applications might include creating a layer of artificial plasma that could reflect communications from a submarine, for example. The US Air Force, which co-funds HAARP with the British Air Force and others, could use the plasma to reflect radio transmissions, bouncing them farther around the globe without losing power, suggests Pederson.

"Instead of depending entirely on the natural ionosphere to redirect radio waves or short-wave broadcasts," Pedersen says, "we are now getting the capability that we can actually produce our own little ionosphere". The results of the February 2008 experiment "make these concepts seem possible".

References

1. Pedersen T. R. & Gerken E. A. *Nature* **433**, 498-500 (2005).
2. Pedersen T. *et al.* *Geophys. Res. Lett.* **36**, L18107 (2009).

Questions

16. Where is the location of the experiment that is the focus of this article? Be as specific as possible in your answer.
17. For about how many years has HAARP been carrying out radio wave experiments?
18. Approximately how much power is normally used for transmitting radio broadcast signals?
19. One technology that can be used to measure plasma density in the ionosphere is mentioned in this article. What is the technology?
20. What reason is attributed to HAARP's success in creating artificial auroras?
21. Based on this article, name two countries whose military is interested in active auroral research.
22. If one wants to learn more details about the successful results described in this article, which journal should one search for? (Abbreviation of the name of the journal is acceptable.)
23. The ionosphere, atmosphere and magnetosphere are three different regions in the environment of the Earth and the near-Earth space. One can infer from this article about the relative heights of these regions. Arrange these three regions in the order according to their heights above the Earth's surface, starting with the lowest.

(背面仍有題目,請繼續作答)

系所組別： 太空天文與電漿科學研究所

考試科目： 科學英文

考試日期：0219，節次：1

※ 考生請注意：本試題 可 不可 使用計算機

Part III: Essay (30%)

Write an English essay of 150 words or more to discuss the following:

What are the factors that make you decide which graduate school(s) and which program(s) to apply for? How is your top choice of graduate schools and programs compatible with those factors?

(Please do not write your essay on this page. Answers on this page will not be marked.)