

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Part 1 (20 points) Choose only 1 correct answer for each question. Each question is worth 2 points.

1. When we put on thick woolen clothing, _____ in the woolen loops that protects us from the cold.
(A) it is the air (B) that the air (C) the air (D) there is the air
2. The two cars for sale were in poor condition, so I didn't buy _____.
(A) either of them (B) both of them (C) neither of them (D) any of them
3. _____ has been used as a perfume for centuries.
(A) To use lavender (B) That the lavender (C) Lavender (D) For the lavender
4. I thought that your _____ of that problem was excellent.
(A) approach (B) conduct (C) handling (D) running
5. The great stone city Angkor flourished for six centuries _____ it fell in 1431.
(A) as soon as (B) so that (C) because (D) until
6. Honey has several functions. Not only does it _____ a sore throat, it can also act as a cough suppressant.
(A) pacify (B) lessen (C) soothe (D) resolve
7. Paying too much attention to a cellphone could _____ relationships with loved ones and friends.
(A) ruin (B) defeat (C) disintegrate (D) restrain
8. Most robots do only one task because once you start adding _____, the robot becomes too heavy and expensive.
(A) profits (B) functions (C) advantages (D) benefits
9. We humans are going to see a(n) _____ from single-task robots to robots that act like a personal assistant.
(A) revolt (B) uprising (C) evolution (D) insolation
10. The company _____ a successful campaign last week as a part of an effort to attract more potential buyers.
(A) legalized (B) launched (C) authorized (D) certified

Part 2 (20 points) Fill in each blank with 1 correct answer. Each question is worth 2 points.

Experts believe that society has a chance to allow technology to be mostly a positive force. 11 making some jobs obsolete, new technologies have also long complemented peoples skills and enabled them 12 more productive – as the Internet and word processing have for office workers or robotic surgery has 13 surgeons. More productive workers, in turn, earn more money and 14 goods and services that improves lives. Just as most of us today have jobs that weren't even 15 100 years ago, the same will be true 100 years from now.

11. (A) In addition to (B) Except for (C) Distant from (D) Apart from
12. (A) being (B) been (C) to be (D) be
13. (A) with (B) like (C) as (D) for
14. (A) increase (B) endorse (C) produce (D) expand
15. (A) invented (B) settled (C) industrialized (D) documented

The greenhouse effect is a naturally occurring process that aids in heating the Earth's surface and atmosphere. It 16 the fact that certain atmospheric gases, such as carbon dioxide, water vapor, and methane, are able to change the energy balance of the planet by absorbing longwave radiation emitted from the Earth's surface. 17 the greenhouse effect life on this planet would probably not exist as the average temperature of the Earth would be a chilly -18° Celsius, 18 the present 15° Celsius. As energy from the Sun 19 the atmosphere, about 51% of the Sun's radiation reaches the surface. This energy is 20 in a number of processes, including the heating of the ground surface; the melting of ice and snow and the evaporation of water; and plant photosynthesis.

16. (A) is because (B) results in (C) results from (D) due to

17. (A) Without (B) In addition to (C) With (D) However,

18. (A) as well as (B) similar to (C) instead (D) rather than

19. (A) leaves (B) passes through (C) cools (D) absorbs

20. (A) used to be (B) is then used (C) then gets used to (D) used

Part 3 (10 points) Identify and correct 5 grammatical errors in the following paragraph. Each error is worth 2 points.

This thesis is based on research of power diodes fabricated on silicon. We obtained the electrical properties of the diodes such like contact resistivity, saturation current, etc. We found the temperature sensitivity of the diode be 2 mV/K . We observed the Einstein's effect of silicon material the first time in the world. We also used optical spectroscopy to detect defects and investigate their effects on power conversion.

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Part 4. (30 points) Read the articles and choose 1 correct answer to each question. Each question is worth 3 points.Article 1 "Battery revolution to evolution," Nature Energy volume 4, page 893 (2019)

So much has been said about the astonishing advancements of and societal transformations brought about by Li-ion batteries (LIBs) in portable electronics, and more recently transportation and grid-scale storage, that the recognition from the 2019 Nobel committee to the three LIB pioneers in October feels long overdue. Nonetheless, the story of their seminal work in laying the foundations of Li-ion chemistry **bears** repeating. At the same time, it is important to recognize the key milestones along the road to today's commercial LIBs and to consider the path ahead to the batteries of the future.

The revolution started during the oil crisis of the 1970s when society was hungering for alternative energy sources to replace fossil fuels. Batteries then, such as lead-acid and nickel-cadmium, did not offer much hope for high-energy output. Writing first in the Journal of the Chemical Society, Chemical Communications in 1974¹, M. Stanley Whittingham noted that ions can be electrochemically intercalated into layered transition-metal disulfides such as TiS_2 . This intercalation chemistry, as he demonstrated subsequently in Science in 1976, enabled the first rechargeable Li battery, which consisted of a TiS_2 cathode and a metallic Li anode².

Writing in the Materials Research Bulletin in 1980³, John Goodenough and co-workers reported a cathode, LiCoO_2 (LCO), that has a similar layered structure to TiS_2 and is also capable of (de)intercalating Li ions. However, this new cathode doubled the operating voltage of TiS_2 and thus led to a significantly higher energy density. Among the many cathode materials, LCO is the most successful for portable devices: it is still being used in the majority of smart phones today.

Early rechargeable Li batteries were only successful in the lab. A main problem lies in the use of metallic Li based anodes, which have high chemical activity leading to significant side reactions. They also tend to form dendrites because of Li-ion plating during charging, which causes the hazard of short-circuiting. This was also one of the scientific reasons behind Exxon's unsuccessful attempt to commercialize Whittingham's Li- TiS_2 system. The breakthrough came with the arrival of a 1985 patent⁴, in which Akira Yoshino and colleagues reported the very first practical Li-ion prototype, presenting carbonaceous materials as the anode and LCO as the cathode in a non-aqueous electrolyte.

26. What is the main purpose of this essay?

- To describe the invention and improvement of Li batteries
- To explain why these researchers deserved the Nobel Prize
- To describe the benefits of the Li battery
- To explain how the Li battery saved the oil crisis of the 1970s.

27. Why does the recognition from the 2019 Nobel committee feel long overdue?
- It has been a long time since its invention.
 - The Nobel committee keeps delaying.
 - Its significance has been well noted.
 - All of the above
28. In the first paragraph, the word **bears** means:
- Supports
 - Allows oneself to be subjected to
 - Has the characteristic of
 - Calls for as suitable or essential
29. What motivated the invention of rechargeable Li battery?
- Lead-acid and nickel-cadmium were discovered to be good materials for rechargeable batteries.
 - Existing batteries were not good alternatives to fossil fuels.
 - People started to become more environment-friendly.
 - All of the above.
30. Why is LCO the most successful material for smartphones?
- It has a lower voltage.
 - It is portable.
 - It has a higher energy density.
 - It uses a layered structure.
31. Why was Exxon unable to commercialize rechargeable Li batteries?
- The technology was immature.
 - The metallic Li-based anodes were problematic.
 - The manufacturing cost was too high.
 - The patent belonged to another company.

Article 2 "Real-time feedback reduces energy consumption among the broader public without financial incentives,"

V. Tiefenbeck, A. Wörner, S. Schöb, E. Fleisch & T. Staake, Nature Energy volume 4, pages 831–832 (2019)

Hotel guests who received real-time feedback on the energy consumed while showering used 11.4% (0.21 kWh) less energy per shower than hotel guests in a control group. The results are important for two reasons. First, they indicate that real-time feedback on a specific activity can induce large behaviour change and resource savings among the broader population and not only among the kind of people who volunteer to participate in energy conservation studies. Second, participants had no financial motives for behaviour change (hotel guests pay a fixed room rate). Even in this setting, the digital behavioural intervention created large conservation effects.

Two potential **caveats** remain. First, we do not know how representative the behaviour of hotel guests is for the tested behaviour compared to the general population. Second, we cannot measure long-term behaviour in a hotel setting. However, in other experiments that we conducted with households over several months, conservation effects from real-time feedback were stable.

32. What is the main idea of this article?

- a. People shower less when there is no financial motive.
- b. Real-time feedback helps people use less energy when showering.
- c. Charging a fixed room rate is important for saving energy in hotels.
- d. The hotel guests continued to save energy over seven months after they returned home.

33. Which of the following statements can be inferred from the article?

- a. All hotel guests reduced their energy use.
- b. The control group only included people who never participated in energy conservation studies.
- c. The guests who never participated in energy conservation studies also reduced their energy use.
- d. The guests who received real-time feedback all volunteered to participate in energy conservation studies.

34. Which of the following statement can be inferred from the article?

- a. The guests used less energy because they paid a fixed room rate.
- b. The guests used less energy because the hotel would give them a discount.
- c. The guests used less energy because they saw how much energy they were consuming.
- d. The guests used less energy because the digital device limited the amount of energy they could use.

35. In this context, the word **caveats** may be replaced by:

- a. Issues
- b. Results
- c. Reasons
- d. Applications

Part 5. (20 points) Writing assignment

In 100-200 words, write an essay to recommend any energy conservation policies, technological applications, and/or future research based on the information in Article 2. A perfect score will be given if:

- There are clear topic sentences. (2 points)
- There are substantial details supporting the topic sentences. (5 points)
- The writing includes the findings in this paper appropriately. (5 points)
- The student uses correct grammar and spelling. (5 points)
- The student uses appropriate vocabulary. (3 points)