注意：考試開始鈴響前，不得翻閱試題，
並不得書寫、畫記、作答。

國立清華大學 114 學年度碩士班考試入學試題

系所班組別：動力機械工程學系
丁組(設計、製造組)

科目代碼：1502

考試科目：科技英文

—作答注意事項—

1. 請核對答案卷（卡）上之准考證號、科目名稱是否正確。
2. 考試開始後，請於作答前先翻閱整份試題，是否有污損或試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 考生限在答案卷上標記「▼ 由此開始作答」區內作答，且不可書寫姓名、准考證號或與作答無關之其他文字或符號。
4. 答案卷用盡不得要求加頁。
5. 答案卷可用任何書寫工具作答，惟為方便閱卷辨識，請儘量使用藍色或黑色書寫；答案卡限用 2B 鉛筆畫記；如畫記不清（含未依範例畫記）致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
6. 其他應考規則、違規處理及扣分方式，請自行詳閱准考證明上「國立清華大學試場規則及違規處理辦法」，無法因本試題封面作答注意事項中未列明而稱未知悉。

國立清華大學 114 學年度碩士班考試入學試題

系所班組別：動力機械工程學系碩士班　丁組(設計、製造組)

考試科目（代碼）：科技英文(1502)

Section I (2.5 points for each question)

Choose the best answer to replace the underlined part of the sentence.

1. The concept of artificial intelligence has ___ significantly in recent decades.
   (A) evolves (B) evolving (C) evolved (D) evolution (E) evolve

2. The researchers concluded that their findings were ___ in developing new theories.
   (A) influence (B) influential (C) influenced (D) influentially (E) influences

3. ___ offer insight into cause-and-effect relationships by demonstrating the outcomes of manipulating particular factors.
   (A) Opinions (B) Experiments (C) Laboratories (D) Schemes (E) Materials

4. The meeting had great difficulty in developing a consensus due to the ___ opinions of members.
   (A) trivial (B) common (C) divergent (D) explicit (E) fundamental

5. The term engineering originates from the word engineer, which can be traced back ___ the 14th century.
   (A) to (B) in (C) at (D) as (E) during

6. The results were ___ and required further investigation.
   (A) unexpected (B) unexpectedly (C) expectation (D) expected (E) expecting

7. Scientific inquiry typically seeks to acquire knowledge through ___ explanations that can help scientists predict the results of future experiments.
   (A) overwhelming (B) novel (C) complex (D) testable (E) natural

8. A tool is an object that enhances an individual's ability to ___ features of the surrounding environment or assists in performing a particular task.
   (A) enforce (B) boost (C) monitor (D) make (E) modify

9. Silicon dioxide, also known as silica, is an oxide of silicon with the chemical formula ___.
   (A) Si_2O_2 (B) SiO_2 (C) Si_2O (D) SiDiO (E) SiO

10. Modern machines are intricate systems composed of structural elements, mechanisms, control components, and ___ for ease of use.
(A) interfaces (B) electricity (C) screens (D) techniques (E) models

11. The peak in the obtained wavelength spectrum was centered at 780 ___.
(A) nm (B) N (C) J (D) nm/s (E) K

12. The material is highly ___ and suitable for electrical applications.
(A) corrosive (B) conductive (C) electrifying (D) transformative (E) diffusive

13. ___ studies friction, wear, and lubrication between interacting surfaces in relative motion.
(A) Astronomy (B) Biology (C) Structural Mechanics (D) Nanotechnology (E) Tribology

14. The test results were ___ with the hypothesis.
(A) concise (B) confident (C) consistent (D) contemporary (E) considerable

15. The speed of light in transparent substances ___ ordinary matter is slower than its speed in a vacuum.
(A) consisting (B) made (C) including of (D) contained of (E) composed of

16. The ___ Development Goals (SDGs) are a collection of 17 global objectives to promote peace, prosperity, and the health of the planet.
(A) Suitable (B) Social (C) Systematic (D) Sustainable (E) Sufficient

17. Data can be viewed as the ___ units of factual information, serving as a foundation for calculation, reasoning, or discussion.
(A) smallest (B) smaller (C) basis (D) largest (E) larger

18. Ten picoseconds are ___ femtoseconds.
(A) 10^3 (B) 10^4 (C) 10^5 (D) 10^7 (E) 10^8

19. In academic writing, failing to properly credit a source for any idea or language taken from someone else is considered ___.
(A) fabrication (B) falsification (C) plagiarism (D) manipulation (E) ghostwriting

20. Before using a chemical, make sure to ___ the material safety data sheet to understand its potential hazards and safety measures.
(A) rewrite (B) review (C) revise (D) recall (E) respond

21. The ___ of water is approximately 1 g/mL at room temperature.
(A) density (B) weight (C) vapor pressure (D) molar mass (E) concentration

22. The use of measurement was developed to enable the recording and comparison of ___ made by different people at various times and locations.
(A) observances (B) observers (C) observatories (D) observations (E) observabilities

23. An argument is ___ if and only if, assuming all the premises are true, the conclusion cannot be false without contradiction.
(A) correct (B) valid (C) true (D) good (E) comprehensive

24. The team faced challenges due to the ___ schedule of the project.
(A) trivial (B) rigid (C) flexible (D) complex (E) rough

25. ___ production was popularized in the late 1910s and 1920s by Ford Motor Company to produce substantial amounts of standardized products.
(A) Mass (B) Weight (C) Kinetic (D) Labor (E) Planned

26. Young's modulus is the ratio of the stress applied to an object and its resulting axial ___ in the linear elastic region of the material.
(A) length (B) pressure (C) hardness (D) stiffness (E) strain

27. While it is ___ of this work, further mathematical derivation is required to clarify the theory.
(A) behind the scenes (B) on the horizon (C) beyond the scope (D) in the loop (E) on the brink

28. A ___ is a semiconductor device used to amplify or switch electrical signals and power.
(A) inductor (B) resistor (C) capacitor (D) transistor (E) resonator

29. Heat flows from the warmer side to the cooler side due to the temperature ___.
(A) gradient (B) gain (C) coefficient (D) constant (E) force

30. The ___ of an integrated circuit protects it and connects it to other electronic components.
(A) board (B) substrate (C) coating (D) bonding (E) packaging

Section II (2.5 points for each question)
Choose the best answer to replace the underlined parts in the following paragraph introducing 3D printing. (Source: Ngo, Tuan D., et al. "Additive manufacturing (3D printing): A review of materials, methods, applications and challenges." *Composites Part B: Engineering* 143 (2018): 172-196.)

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3D printing is an additive manufacturing (AM) technique for fabricating a wide range of structures and complex geometries from three-dimensional (3D) model data. The process consists of printing _31_ layers of materials that are formed on top of each other. This technology has been developed by Charles Hull in 1986 in a process known as stereolithography (SLA), which was followed by _32_ developments such as powder bed fusion, fused deposition modelling (FDM), inkjet printing and contour crafting (CC). 3D printing, which involves various methods, materials and equipment, has evolved over the years and has the ability to transform manufacturing and logistics processes. Additive manufacturing has been widely applied _33_ different industries, including construction, prototyping and biomechanical. The uptake of 3D printing in the construction industry, in particular, was very slow and limited _34_ the advantages e.g. less waste, freedom of design and automation.

****

31. (A) suspended (B) smooth (C) developed (D) successive (E) stable
32. (A) subsequent (B) consequent (C) corresponding (D) comparative (E) involving
33. (A) in (B) as (C) for (D) of (E) with
34. (A) due to (B) resulting in (C) besides (D) despite (E) without

Section III (3 points for each question)

Answer the following questions based on the figures and the captions.

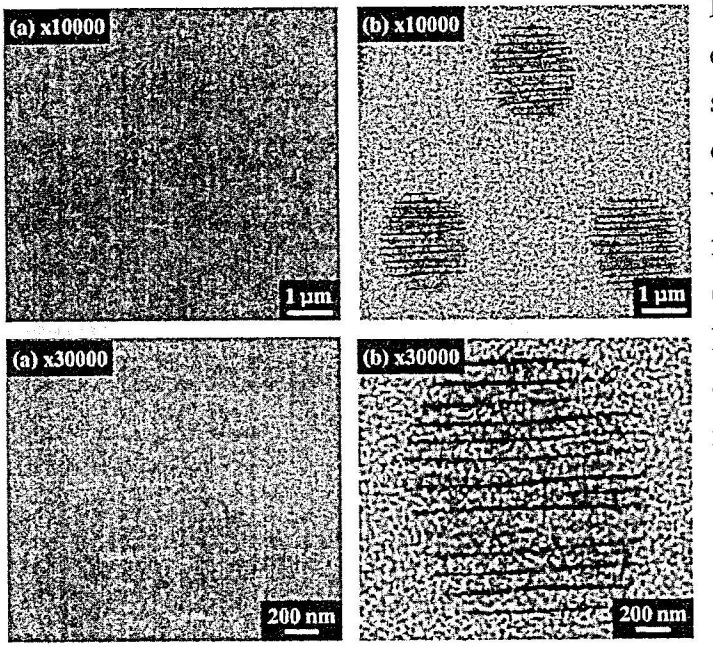

Figure 1. (a) Secondary electron images of silica glass surface polished close to the depth of the laser focal spot where the periodic patterns formed due to laser irradiation. (b) Light "fingerprints": Backscattering electron images of the same surface. The magnification of the upper and lower images is 10000 and 30000, respectively. (Source: Shimotsuma, Yasuhiko, et al. "Self-organized nanogratings in glass irradiated by ultrashort light pulses." *Physical review letters* 91.24 (2003): 247405.)

35. Which sub-figure in Figure 1 shows the details of the periodic patterns in silica glass most clearly?

(A) Low-magnification secondary electron image

(B) High-magnification secondary electron image

(C) Low-magnification backscattering electron image

(D) High-magnification backscattering electron image

(E) Superimposed electron image

36. Choose the **correct** description of Figure 1.

(A) The diameter of one zone of the laser-induced periodic patterns and the periodicity of fine structures in the periodic patterns were approximately 200 nm and 1 μm, respectively.

(B) All sub-figures were taken on the same surface of the measured silica glass sample.

(C) The periodic patterns in silica glass generated during electron beam exposure.

(D) The author, Yasuhiko Shimotsuma, can be younger than 20 years old.

(E) None of the above.

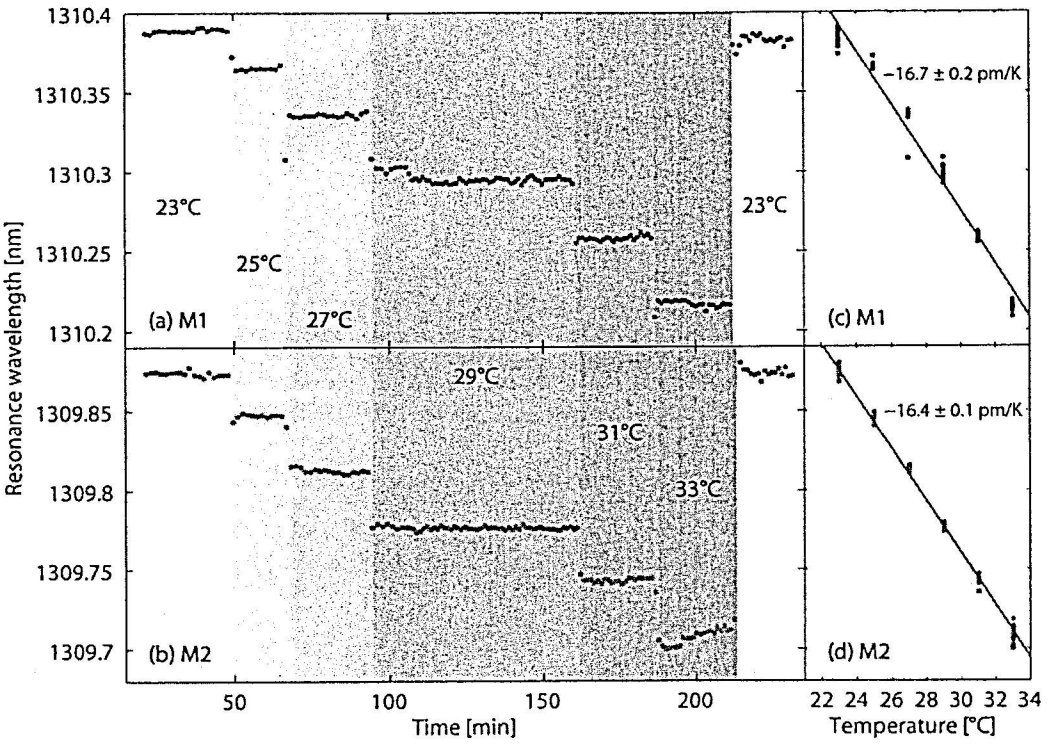

Figure 2. The left panels show the resonance wavelengths of (a) channel M1, and (b) channel M2, as functions of time during temperature stepping from 23.0°C to 33.0°C and a jump back to 23.0°C. The right panels show the corresponding resonance wavelengths of (c) channel M1, and (d) channel M2, as functions of temperature. The slopes of the fitted lines yield the temperature sensitivities of the sensors. (Source: Gylfason, Kristinn B., et al. "On-chip temperature compensation in an integrated slot-waveguide ring resonator refractive index sensor array." *Optics express* 18.4 (2010): 3226-3237.)

37. How many channels was the data shown in Figure 2 collected from?
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

38. Choose the **incorrect** description of Figure 2.
(A) The measured resonance wavelengths of Channel M1 were overall larger than

those of Channel M2.

(B) The measured resonance wavelength of Channel M1 kept decreasing with increasing temperatures.

(C) The measured resonance wavelength of Channel M2 kept decreasing with increasing operation time.

(D) The highest tested temperature shown in the figure was 33°C.

(E) The difference in sensitivity between Channel M1 and M2 was smaller than 0.5 pm/K.

39. Choose the **correct** description of Figure 2.

(A) The entire testing of the sensors began at 23°C and ended at 33°C.

(B) The figure was published in a journal paper with only one author.

(C) The operation temperature of the sensors at the time point of 40 minutes was 25°C.

(D) The variation in the measured resonance wavelength of Channel M1 across the entire test was smaller than 150 pm.

(E) The operation temperature of the sensors was changed by 6 times.