

2025 Master's Program, Graduate School of Design (General Entrance Examination) Achievement Test
Question Sheets

Examination Subject Architectural Engineering and Environmental Chemistry

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Question 1 (Compulsory)

Describe each of the following 20 keywords related to environmental design.

- (1) Basilica
- (2) Sick building syndrome
- (3) Cooperative house
- (4) Carbon negative concrete
- (5) Nature-based Solutions
- (6) Tatsuno Kingo
- (7) Chemical weapon
- (8) *The Limits to Growth*
- (9) COVID-19
- (10) Mies van der Rohe
- (11) Ecosystem service
- (12) Vibration control of buildings
- (13) Cross laminated timber (CLT)
- (14) Specialization of environmental design
- (15) *Shinden-zukuri* style
- (16) Park system
- (17) Metabolism (architectural movement)
- (18) Curtain wall
- (19) Area classification system
- (20) World Heritage Convention

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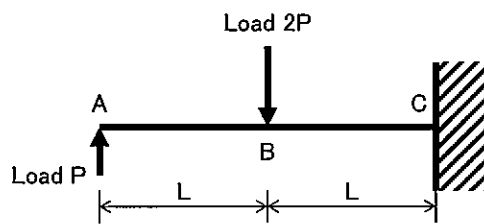
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- *Choose and answer two questions from Question 2 to Question 5. If you answer more than three questions, your answer will not be marked.
 - *When answering the questions, use a separate answer sheet for each question. Each answer should be on a single sheet. The first question of your choice must be answered on the third sheet of paper and the second question on the fourth sheet of paper.

Question 2 Answer the following questions on Structural Engineering.

For the cantilever beam shown in the figure below, answer (1) through (4). The second area moment of inertia is I and the section modulus is Z . The Young's modulus of the material is E .



- (1) Calculate the support reactions. (10 points)
- (2) Calculate the shear force and bending moment and draw the shear force and bending moment diagrams. (20 points)
- (3) Calculate the maximum value of the concentrated load P that satisfies $\sigma \leq f$. Note that σ is the bending stress and f is the bending strength. (10 points)
- (4) Calculate the vertical displacement at point B. In the calculation, only bending deformation is considered. (10 points)

Question 3 Answer the following questions on Building Materials.

- (1) Explain what the alkali-silica reaction in concrete is, and list three possible measures to control it. (15 points)
- (2) Briefly explain what is needed to prevent wood decay and insect damage. (10 points)
- (3) Ceramic tiles are broadly classified into three groups based on their water absorption rate. Explain the desirable usage environment for each group. (10 points)
- (4) Schematically illustrate the stress-strain relationship of general steel (When the yield point is clearly visible), and illustrate the following six points "a" to "f" and "E". (15 points)
 - a. proportional limit
 - b. elastic limit
 - c. upper yield point
 - d. lower yield point
 - e. tensile strength
 - f. break pointE. modulus of elasticity

Question 4 Answer the following questions on Environmental Engineering.

- (1) A classroom with a volume of 200.0 m^3 had a carbon dioxide concentration of 1000 ppm at the end of class. At the end of the class, the classroom was unoccupied and carbon dioxide emissions were zero. Thirty minutes after the end of class, the carbon dioxide concentration in the classroom was 800 ppm. During this period, the ventilation rate remained constant. Calculate the amount of ventilation in this classroom when the concentration of carbon dioxide in the outside air is 400 ppm. Note that $\ln 2 = 0.69$ and $\ln 3 = 1.10$. Give the units in your answer. (15 points)
- (2) Derive the one-dimensional unsteady heat conduction equation using Fourier's law. (15 points)

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(3) Explain how to measure static pressure in a duct using a U-tube manometer. (10 points)

(4) Explain the principle of operation of a heat pump. (10 points)

Question 5 Answer the following questions on Environmental Chemistry.

- (1) The size of supplements market continues to expand year by year. A serious health hazard occurred in 2024, since some chemicals were accidentally produced in the process of rice fermentation using monascus (red yeast). Explain what is necessary to investigate the reason of occurring this health hazard from a scientific point of view. (20 points)
- (2) A proposal was shared among numerous countries for aiming to eliminate the additional environmental pollution caused by marine plastic wastes by 2050 in the 2019 G20 Osaka Summit. Describe the possible approach to recycle the waste plastics. (15 points)
- (3) The use of biofuels is desirable for achieving carbon neutrality. Explain what kind of biofuels are used in industry, what are biofuels used for, and what are the important characteristics of biofuels. (15 points)

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Answer Sheets

Examinee's number

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Question 1

Write your answer along the ruled line corresponding to the keyword number.

(1)

(2)

(3)

(4)

(5)

(6)

(7)

(8)

(9)

(10)



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Question 1

Write your answer along the ruled line corresponding to the keyword number.

(11)

(12)

(13)

(14)

(15)

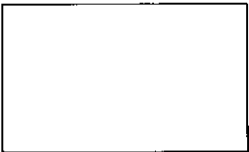
(16)

(17)

(18)

(19)

(20)



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Question____ (Write the number of the question which you answer from question 2 to question 5 along the under line.)



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Question____ (Write the number of the question which you answer from question 2 to question 5 along the under line.)

