

2026 Master's Program, Graduate School of Design (General Entrance Examination) Achievement Test  
Question Sheets

Examination Subject  
Architectural Engineering and  
Environmental Chemistry

(Page 1 of 5)

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Question 1 (Compulsory)

Describe each of the following 20 keywords related to environmental design. (5 points × 20 questions)

- (1) Short-term load
- (2) *Zenshuyo* Style
- (3) Garden city
- (4) Cross rib vault
- (5) Territory
- (6) Asbestos
- (7) Landscape Act in Japan
- (8) Plane (tool)
- (9) Law for the Protection of Cultural Properties (Japan)
- (10) Marine pollutant
- (11) City park
- (12) Crowd
- (13) Conservation of *satoyama*
- (14) Brutalism
- (15) Habitat 67
- (16) La Ville Radieuse
- (17) Art nouveau
- (18) Other effective area-based conservation measures (OECM)
- (19) Heat pump
- (20) Carbon negative

- \* 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.

(1) For the simply supported beam shown in Figure 1, calculate the vertical displacement at point C. Assume that the moment of inertia of the beam is  $I$ . Member AB is an elastic bar with Young's modulus  $E$ , and member BC is a rigid bar with Young's modulus assumed to be  $E_{BC} \rightarrow \infty$ . Neglect self-weight and consider only bending deformation in the calculation. (20 points)

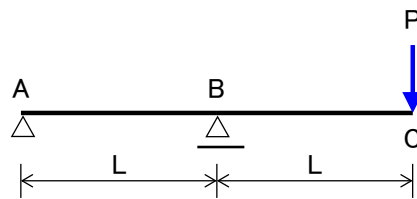


Fig. 1

(2) For the truss structure shown in Figure 2, calculate the vertical displacement at point B under the maximum load that satisfies the condition  $\sigma \leq f$ , where  $\sigma$  is the normal stress and  $f$  is the material strength. Assume the following conditions for the calculation. (30 points)

- The cross-sectional areas of members AB and BC are  $A$ , and that area of member AC is  $9A/5$ .
- All members have the same Young's modulus  $E$ .
- Self-weight of the members may be neglected.

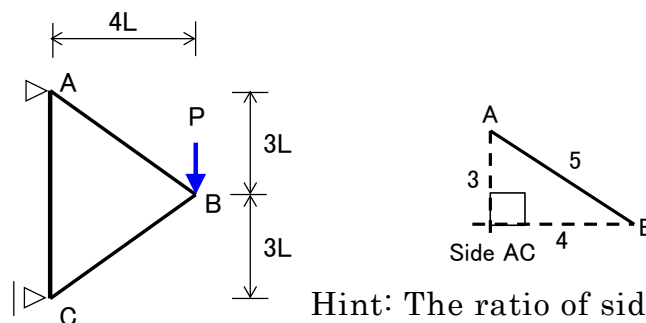


Fig. 2

Hint: The ratio of side lengths in the right triangle.

Question 3 Answer the following questions on Building Materials.

(1) Describe the characteristics and uses of granite and marble among the stone materials used for the interior and exterior of buildings. (10 points)

(2) 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 point    E. Young's modulus

2026 Master's Program, Graduate School of Design (General Entrance Examination) Achievement Test  
Question Sheets

Examination Subject  
Architectural Engineering and  
Environmental Chemistry

(Page 3 of 5)

(3) Briefly explain burn design, indicating the difference between “ignition” and “spontaneous combustion” in the wood combustion process. (10 points)

(4) The following is part of a table of specified mix proportion of concrete formulations. Find (a) through (e) obtained from this table. Make sure that you write the formulas and units. (a) and (c) should be indicated by two significant digits, (b) by four significant digits, and (d) and (e) by three significant digits. (15 points)

Specified Mix Proportion Table

(Aggregate is in surface dry condition, water absorption of aggregate does not need to be taken into account)

Unit water volume [kg/m <sup>3</sup> ]	Absolute volume [L/m <sup>3</sup> ]			Mass [kg/m <sup>3</sup> ]		
	Cement  V <sub>c</sub>	Sand aggregate  V <sub>s</sub>	Coarse aggregate  V <sub>g</sub>	Cement  G <sub>c</sub>	Sand aggregate  G <sub>s</sub>	Coarse aggregate  G <sub>g</sub>
173	93	295	396	294	767	1049

- (a) Water cement ratio
- (b) Unit volumetric mass of concrete after mixing
- (c) Air content of concrete
- (d) Density of cement
- (e) Sand aggregate ratio

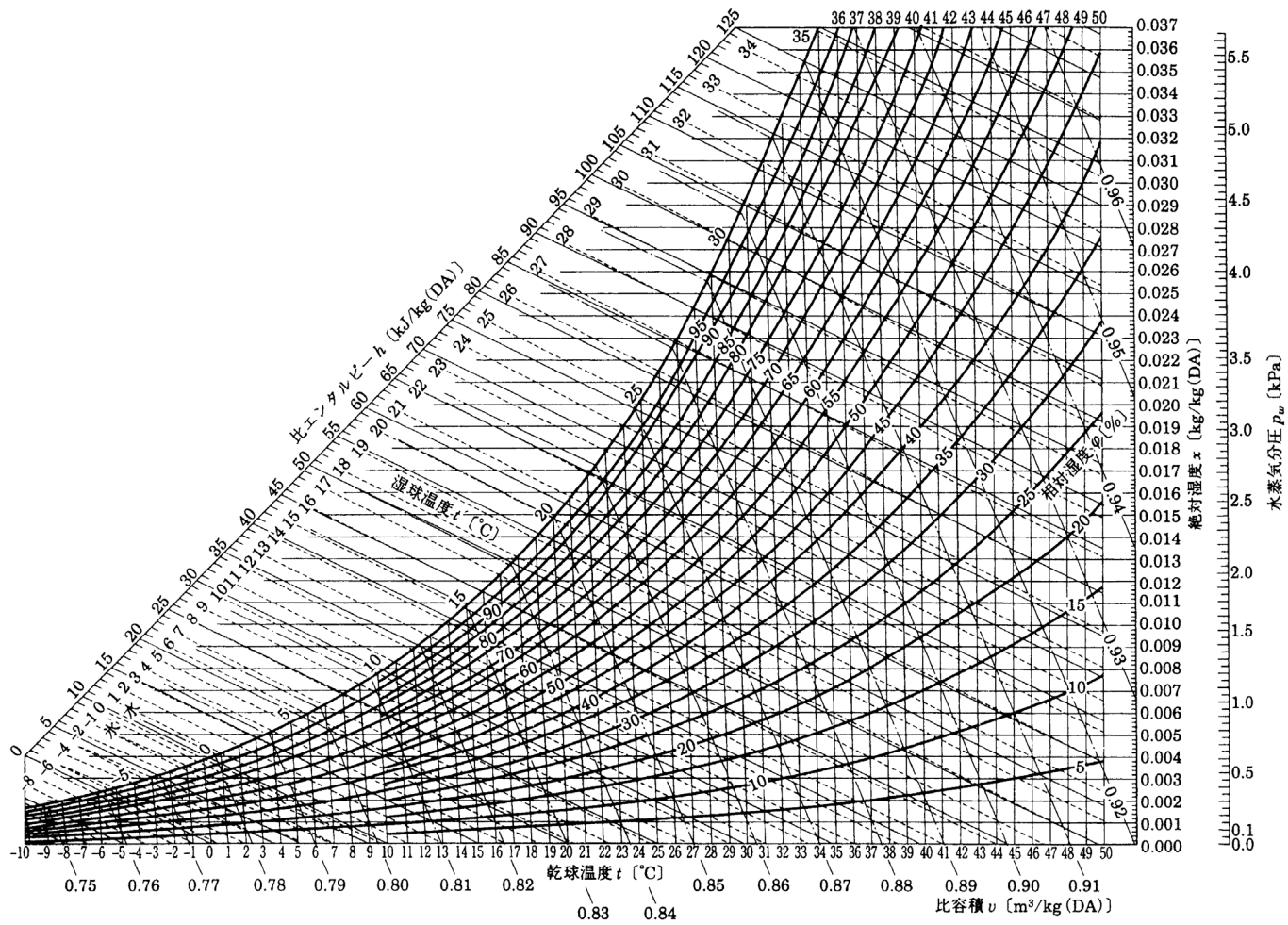
Question 4 Answer the following questions on Environmental Engineering.

(1) Calculate the range of glass wool thickness required to prevent condensation on the interior surface of a wall with the specified construction when the indoor air temperature is 20.0 °C, relative humidity is 90%, and the outdoor air temperature is 0.0 °C. Assume the concrete and wood thicknesses are fixed. For calculations, consider steady-state conditions with the following: interior total heat transfer coefficient of 10.0 W·m<sup>-2</sup>·K<sup>-1</sup>, and exterior total heat transfer coefficient of 25.0 W·m<sup>-2</sup>·K<sup>-1</sup>. (15 points)

	Thickness $d$ [mm]	Thermal conductivity $\lambda$ [W·m <sup>-1</sup> ·K <sup>-1</sup> ]
Concrete (Exterior)	90	1.50
Glass wool	?	0.04
Wood (Interior)	15	0.15

Examination Subject  
Architectural Engineering and  
Environmental Chemistry

(Page 4 of 5)



(2) Calculate the maximum height at which a device requiring a minimum water pressure of 120 kPa can be supplied directly from a water main with a water pressure of 0.25 MPa using direct pressure supply method given a friction loss of 10 kPa per vertical meter. For calculations, use standard values for all physical quantities required. (15 points)

(3) Based on Avogadro's law, provide a reason which is lighter, "dry air" or "moist air." (10 points)

(4) Explain what the "solar constant" is. Also, explain why the solar constant can change even when solar activity remains constant. (10 points)

Question 5 Answer the following questions about environmental chemistry.

(1) Recently, the market size of products called supplements and health foods has expanded rapidly, and it is said that about 30% of Japanese people currently consume them. However, there was a case which people who consumed health foods containing red yeast rice complained of health damage in 2024. Please answer what is needed to prevent such problems. (15 points)

(2) The use of biofuels is being considered to solve the energy problem, and artificial intelligence (AI) is also being used in the field of environmental chemistry, such as research on predicting the characteristics of biofuels using AI. Think about how AI can be used in the field of environmental chemistry to improve the global environment, and answer it as specifically as possible. (20 points)

2026 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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(Page 5 of 5)

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(3) PFAS is a general term for perfluoroalkyl and polyfluoroalkyl compounds, which have been pointed out as having the potential to accumulate in the human body through livestock products and drinking water, and having the potential to have adverse effects on health. Please answer how PFAS had been used and what kind of removal methods are possible. (15 points)

Examination Subject  
Architectural Engineering and  
Environmental Chemistry

# Answer Sheets

Examinee's number

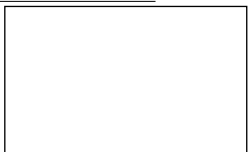
(Page 1 of 4)

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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) \_\_\_\_\_  
\_\_\_\_\_



Examination Subject Architectural Engineering and Environmental Chemistry
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# Answer Sheets

Examinee's number

(Page 2 of 4)

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Question 1 (continued)

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

(11) \_\_\_\_\_

(12) \_\_\_\_\_

(13) \_\_\_\_\_

(14) \_\_\_\_\_

(15) \_\_\_\_\_

(16) \_\_\_\_\_

(17) \_\_\_\_\_

(18) \_\_\_\_\_

(19) \_\_\_\_\_

(20) \_\_\_\_\_



Examination Subject Architectural Engineering and Environmental Chemistry
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## Answer Sheets

Examinee's number

(Page 3 of 4)

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Question \_\_\_\_ (Write the number of the question which you answer from question 2 to question 5 along the underline.)



Examination Subject Architectural Engineering and Environmental Chemistry
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## Answer Sheets

Examinee's number

(Page 4 of 4)

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Question \_\_\_\_ (Write the number of the question which you answer from question 2 to question 5 along the underline.)

