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

Examination Subject Media Science

Examinee's number

Question 1 is a compulsory question. All of Questions 1-1, 1-2, and 1-3 must be answered by all examinees. Question 2 is an elective question. You must choose two of the three questions [Questions 2-1, 2-2, and 2-2] to answer.

Question 1 (Compulsory questions)

Answer the following three questions. .

・Question 1-1. Illustrate four types of geometrical illusions and briefly explain how each illusion appears. (20 points)

Intent of the Question

This question tests examinees' basic knowledge of illusions, which is necessary for conducting research in the master's program.

・Question 1-2. Stevens, Stanley Smith, refers to the level of strictness of the rules for assigning numbers that define a scale as "levels, or scales, of measurement" (e.g., Stevens (1946) "On the theory of scales of measurement"). Among these levels of measurement, explain "interval scale" in as much detail as possible. (20 points)

Intent of the Question

"Levels of measurement" is a psychological measurement method and basic knowledge for considering the mind as something measurable, and quantifying it numerically. The question was intended to assess examinees' understanding of the "levels of measurement" based on how clearly the examinees could state the definition of "interval scale." This is because we expect examinees to have a basic understanding that will allow them to carry out psychological experiments and process data without any problems after entering the graduate school.

・Question 1-3. Explain "luminance" as a lighting vocabulary and the "unit: cd/m^2 (unit of measurement)" of luminance in as much detail as possible. You may use diagrams if necessary. (20 points)

Intent of the Question

This question tests examinees' basic knowledge of luminance, which is a unit for quantifying the intensity of stimuli to the human visual system.

Question 2 (Elective question)

Choose two from the following three questions [Questions 2-A, 2-B, and 2-C] and answer.

Question 2-A. Answer the three questions listed below. (70 points)

・Give two examples of the illusions of visual object motions and explain them in as much detail as possible. Diagrams may be used.

Intent of the Question
This question tests examinees' basic knowledge of motion perception, which is necessary for research in the master's program.

・Give examples of subjective contours and describe them in as much detail as possible. Diagrams may be used.

Intent of the Question
This question tests examinees' basic knowledge of shape perception, which is necessary for research in the master's program.

・Explain the blind spot in as much detail as possible. Diagrams may be used.

Intent of the Question
This question tests examinees' basic knowledge of the mechanisms of vision, which is necessary for research in the master's program.

Question 2-B.

If the subjective strength of vection is obtained using the magnitude estimation method, which level is the subjective value considered to be at among Stevens' four levels of measurement? Explain your ideas as clearly as possible, giving examples of statistical methods used in previous research on vection. (70 points)

Intent of the Question

This question asks about how the basic knowledge of psychological measurement methods can be applied to psychological experiments in the field. It was assumed that examinees who have knowledge of past experimental papers and their statistical methods should be able to provide their own thoughts on the magnitude of vection. In particular, since there is no single conclusion, if they show the willingness to discuss various possibilities, it means that they have demonstrated their scientific perspective. Finally, if their answers show that they have thought about the reproducibility of psychology, an important recent concept, this question will also confirm that they have applied and deep insight.

As long as examinees had a basic understanding and could provide examples of its application, they were given a passing grade even if they did not discuss a wide range of possibilities or consider the issue of reproducibility. The latter was provided as an additional point for examinees who had studied deeply. It was also intended to assess their ability to conduct psychological experiments and process data after enrollment.

Question 2-C.

1) Visual colorimetry is a method of measuring color using the Munsell color chart. Explain the method of visual colorimetry. Furthermore, list three points to be considered when measuring color and explain why. (40 points)

2) Given a display that reproduces colors by additive color mixing of the three primary colors of RGB, calculate the xy chromaticity and luminance of the reproduced color if the CIE 1931 xy chromaticities and luminances of R, G, and B are as shown in the table below, respectively. Round to the fourth decimal place. (30 points)

Primary	CIE 1931 chromaticity		Luminance
	x	y	(cd/m^2)
R	0.64	0.33	16.5
G	0.30	0.60	30.0
B	0.15	0.06	12.0

1) Intent of the Question

The knowledge of visual systems is required to use the visual colorimetry. This question tests not only the knowledge of one method of colorimetry but also the knowledge of the visual systems.

2) Intent of the Question

This question is about the CIE 1931XYZ color system. It tests the level of understanding of the CIE 1931XYZ color system by calculating chromaticity using mathematical formulae.

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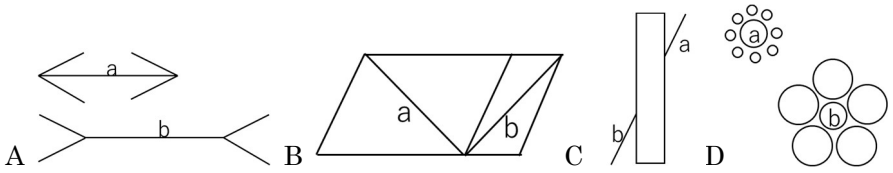
Question 1 (Compulsory questions)

Answer the following three questions. .

・Question 1-1. Illustrate four types of geometrical illusions and briefly explain how each illusion appears. (20 points)



A. Müller-Lyer illusion: Although the horizontal lines *a* and *b* are the same length, *b* appears to be longer than *a*.
B. Sander illusion: The oblique line *a* appears to be longer than *b*, though they are the same length.
C. Poggendorff illusion: Although *a* and *b* are aligned in a straight line, *a* appears to be shifted upward while *b* appears to be shifted downward.
D. Ebbinghaus illusion: Although *a* and *b* are the same size, the *b* circle appears to be smaller than the *a* circle.

・Question 1-2. Stevens, Stanley Smith, refers to the level of strictness of the rules for assigning numbers that define a scale as "levels, or scales, of measurement" (e.g., Stevens (1946) "On the theory of scales of measurement"). Among these levels of measurement, explain "interval scale" in as much detail as possible. (20 points)

The interval scale is a scale that expresses the magnitude of the difference in some quantity in the object of measurement as the magnitude of the difference between the measured values.

In addition to the size of the numbers, the difference also has meaning, and the origin can be determined arbitrarily. Values can be added and subtracted, but multiplication and division are not possible. The ratio of numbers has no meaning, but the ratio of the difference between numbers does. It is also called an equal unit scale.

Specific examples include temperature (Celsius), years (e.g. 2014), subjective ratings such as giving something a score out of 10, and intelligence quotient.

・Question 1-3. Explain "luminance" as a lighting vocabulary and the "unit: cd/m² (unit of measurement)" of luminance in as much detail as possible. You may use diagrams if necessary. (20 points)

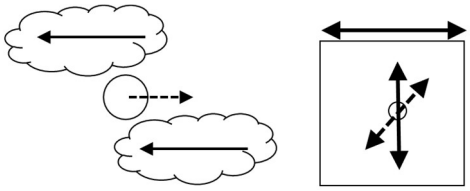
Luminance is not the same amount of energy (radiometric quantity) as electromagnetic waves but a photometric quantity that expresses the intensity of light to humans. There are two types of luminance: scotopic luminance and photopic luminance. When luminance is simply referred to, it means photopic luminance. Luminance is given in luminous flux in lumen (lm) emitted per unit area (/m²) and unit solid angle (/sr). The luminous flux (lm) is calculated by multiplying the radiant flux for each wavelength of light (W: watt) by the spectral luminous efficiency, which indicates how sensitive humans are to each wavelength in the visible light range. The spectral luminous efficiency is normalized at 556 nm, with a maximum luminous efficiency coefficient of 683 lm/W at 556nm.

Question 2 (Elective question)

Choose two from the following three questions [Questions 2-A, 2-B, and 2-C] and answer.

Question 2-A. Answer the three questions listed below. (70 points)

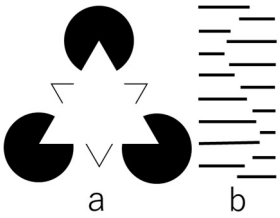
・Give two examples of the illusions of visual object motions and explain them in as much detail as possible. Diagrams may be used.



1) Induced motion: There is a known example of the moon appearing to move in the opposite direction to the clouds. When there is a large object moving near a certain object, the object appears to move in the opposite direction to the surrounding motion. As shown in the diagram on the right, when the object moves up and down and the surrounding frame moves left and right, the object appears to move diagonally.

2) Waterfall illusion (motion aftereffect): After looking at a waterfall for a long time, if you then look at a stationary object, you will perceive that the object is moving upwards. It is thought that this is because the mechanism for perceiving movement in a certain direction becomes fatigued after looking at movement in that direction for a long time, and the mechanism for perceiving movement in the opposite direction becomes relatively more sensitive, causing a stationary object to appear to be moving in the opposite direction.

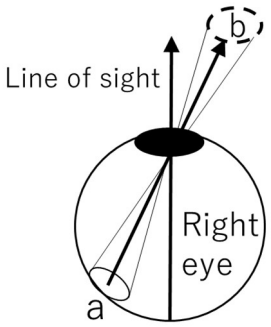
・Give examples of subjective contours and describe them in as much detail as possible. Diagrams may be used.



A subjective contour is an image in which we perceive a boundary even though there is no physical line and there is no difference in brightness or color on either side of the boundary. Figure (a) is a typical example of this, and is called the Kanizsa triangle. The part that appears to be a white triangle is the same brightness as the surrounding white, and although the triangle's outline does not exist physically, perceptually it appears to be a triangle that is brighter than the background and partially occludes the black disc.

Figure (b) shows a different type of subjective contour, where a vertical curve is perceived, but there is no difference in brightness on either side of it, and the black line itself does not form part of the subjective contour.

・Explain the blind spot in as much detail as possible. Diagrams may be used.



The area of the optic disc on the retina (a) where there are no photoreceptors cannot capture images with the eye. Therefore, the area of the visual field corresponding to the position of the optic disc (b) is called the blind spot. In the right eye, it is on the right side of the line of sight, and in the left eye, it is on the left side. Because the blind spot is filled in with visual information from the surrounding area, even if one is looking with one eye, they will not notice the blind spot. When looking with both eyes, the blind spots of each eye do not overlap in the field of vision, so the information from the eye with the blind spot can be supplemented by the information from the opposite eye. Because the eyes are constantly moving around, the image that enters the blind spot area also changes, and because the blind spot is in the peripheral vision, it is difficult to pay attention to it. These are also thought to be reasons why it is difficult to notice the existence of the blind spot.

Question 2-B.

If the subjective strength of vection is obtained using the magnitude estimation method, which level is the subjective value considered to be at among Stevens' four levels of measurement? Explain your ideas as clearly as possible, giving examples of statistical methods used in previous research on vection. (70 points)

This is not the only correct answer, but as a way of assessment, we are checking whether examinees' own thoughts are reflected in their answers based on their understanding of the case to the extent shown in the example answer.

There are two types of subjective intensity: magnitude estimation and rating scale. Magnitude estimation involves subjectively assigning a score to the intensity of vection caused by a stimulus after the presentation of the stimulus that induces vection has ended. This score is the magnitude. Generally, subjects answer by assigning a score to the subjective intensity in comparison to the intensity of vection caused by some kind of comparative stimulus, or in technical terms, a "standard stimulus." This is a method known as the magnitude estimation method in psychology. Therefore, this index is sometimes referred to simply as "magnitude." Next, the rating scale is sometimes called a "rating," and the subjective strength is given a score from 0 to 100 or 10 points out of 10. For example, 0 means that no vection is felt, and 100 means that a very strong vection is felt.

The above numerical operations are generally considered to be equivalent to the "interval scale" mentioned in the previous answer or the higher-level "proportional scale." Although a lower-level "ordinal scale" also satisfies the criteria, it corresponds best to the order of terms in the interval scale described above. In fact, previous papers on vection research customarily apply statistical processing (such as T-tests) to the magnitude, which shows that it is considered to be a scale higher than the rank scale. If 0 has meaning, it becomes a proportional scale, allowing analysis of variance to be performed.

However, this psychological scale has many problems. Since the establishment of the Weber-Fechner law, the situation of a magnitude of 0, or a sensory amount of 0, has the problem that it cannot be conceptually defined in terms of the amount of stimulation. Similarly, there is also the question of whether the intervals are truly equal. If the differences in all values cannot be treated equally, it must be treated as an ordinal scale.

Currently, there is a lack of a unified conceptual understanding of these numbers and how to manipulate them in vection research. The scale of what is considered the magnitude of vection is left to the discretion of each individual researcher. In order to ensure a higher level of scientific reproducibility, the entire scientific community must come to terms with this issue.

Question 2-C.

1) Visual colorimetry is a method of measuring color using the Munsell color chart. Explain the method of visual colorimetry. Furthermore, list three points to be considered when measuring color and explain why. (40 points)

2) Given a display that reproduces colors by additive color mixing of the three primary colors of RGB, calculate the xy chromaticity and luminance of the reproduced color if the CIE 1931 xy chromaticities and luminances of R, G, and B are as shown in the table below, respectively. Round to the fourth decimal place. (30 points)

Primary	CIE 1931 chromaticity		Luminance
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B	0.15	0.06	12.0

1) Visual colorimetry is a method of selecting Munsell color charts that match the color of the surface, and the color of the surface to be measured is determined by the Munsell notation of the selected Munsell color chart. If there is no matching color chart for it, the color may be interpolated from close colors. The three points to note and the reasons are as follows.

· The measurement should be carried out under the illuminant C or the illuminant D65.
(Reason) Because the Munsell color chart is a color system defined under the illuminant C, and the uniformity of hue, value, and chroma is maintained under the illuminant C.

· The measurement should be carried out under an illuminance of 500 lx or more.
(Reason) To eliminate the influence of rod cells that work in the scotopic vision and the mesopic vision.

· The measurement should be carried out using a medium grey such as N5 on the the Munsell color chart.
(Reason) To eliminate the influence of surrounding colors such as color induction, brightness induction, etc.

2) The color created by additive color mixture is the sum of the tristimulus values X, Y, and Z of the colors used in the mixture. From chromaticity (x, y) and luminance Y, X=x/y*Y and Z=(1-x-y)/y*Y, and then the tristimulus values X, Y, and Z of the reproduced color will be as follows.

X=0.64/0.33*16.5+0.30/0.60*30.0+0.15/0.06*12.0=77.0
Y=16.5+30.0+12.0=58.5
Z= (1.0-0.64-0.33)/0.33*16.5+(1.0-0.30-0.60)/0.60*30.0+(1.0-0.15-0.06)/0.06*12.0=164.5

From x=X/(X+Y+Z) and y=Y/(X+Y+Z), the chromaticity (x, y) and luminance Y of the reproduced color are (0.257, 0.195) and 58.5 cd/m^2, respectively.