

ILLUMINATION

EXERCISE 12b

SECTIONS 12.15-12.18

DIRECTIONS: In the parentheses at the right of each word or expression in the second column, write the letter of the expression in the first column that is MOST CLOSELY related.

- | | | |
|---|-----------------------|--------|
| a. Several rays of light coming from a point | luminous | () 1 |
| b. Transmits light but diffuses it | illuminated | () 2 |
| c. Seen because of reflected light | transparent substance | () 3 |
| d. A group of closely spaced rays | opaque substance | () 4 |
| e. Gives off light because of energy of its accelerated particles | ray | () 5 |
| f. Some rays of light are excluded | beam | () 6 |
| g. A single line of light | diverging pencil | () 7 |
| h. Several rays of light proceeding toward a point | converging pencil | () 8 |
| i. Transmits light readily | umbra | () 9 |
| j. Point at which light rays converge | penumbra | () 10 |
| k. Does not transmit light | | |
| l. All rays of light are excluded | | |

DIRECTIONS: In the space at the right, place the letter or letters indicating EACH choice that forms a complete statement.

11. In the practical study of light, all of the following are measured except (a) luminous intensity, (b) luminous flux, (c) luminous velocity, (d) illuminance. _____ 11
12. The luminous intensity of a 40-watt incandescent lamp is approximately (a) 35 candelas, (b) 40 candelas, (c) 80 candelas, (d) 20 candelas. _____ 12
13. The efficiency of incandescent lamps in terms of the ratio of light output to wattage rating (a) increases with wattage increase, (b) decreases with wattage increase, (c) is constant for a given filament metal, (d) appears to be independent of the wattage. _____ 13
14. The photometric quantity most closely related to power in mechanical systems is (a) luminous intensity, (b) luminous flux, (c) illuminance, (d) candle power. _____ 14
15. A 100-watt incandescent lamp emits luminous flux at the rate of approximately (a) 100 lm, (b) 130 lm, (c) 1600 lm, (d) 314 lm. _____ 15
16. A 16.0-candela source at the center of a sphere of 1.00-m radius provides illuminance on the spherical surface of (a) 16.0 lm/m², (b) 4π lm/m², (c) 4.00 lm/m², (d) 201 lm/m². _____ 16

17. If the spherical radius in No. 16 is increased to 4.00 m, the illumination on the spherical surface becomes (a) 64.0 lm/m², (b) 4.00 lm/m², (c) 50.2 lm/m², (d) 1.00 lm/m². _____ 17
18. The maximum illuminance obtained from a 40.0-candela source 3.00 meters away is (a) 4.44 cd, (b) 13.3 lm/m², (c) 4.44 lm/m², (d) 120 cd. _____ 18
19. If the luminous intensity of the source in No. 18 is tripled, the maximum illuminance 3.00 meters away is (a) 13.3 cd, (b) 13.3 lm/m², (c) 40.0 lm/m², (d) 120 cd. _____ 19

nature of light

23

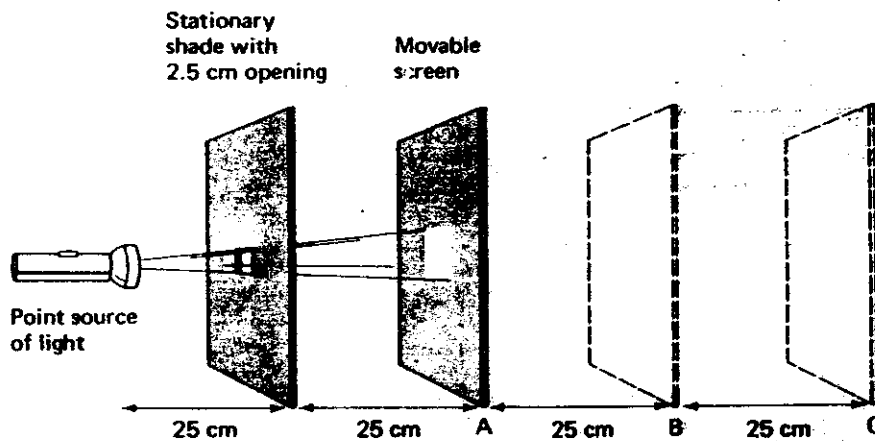
DIRECTIONS: Match each item in the right column with the letter of the best response in the left column.

- From lens to principal focus
- Can be projected
- Cannot be projected
- Light-sensitive lining
- Weakness in near vision
- Weakness in distance vision
- Optical illusion
- Bending of light rays
- Converging lens
- Diverging lens

- Nearsightedness () 1.
- Focal length () 2.
- Retina () 3.
- Virtual image () 4.
- Concave () 5.
- Refraction () 6.
- Farsightedness () 7.
- Real image () 8.
- Mirage () 9.
- Convex () 10.

DIRECTIONS: Questions 11-14 refer to Fig. 23-1. Answer each question in the space provided.

Fig. 23-1



- How many square centimeters of screen are illuminated at position A? _____ 11
- How many square centimeters of screen are illuminated
 - if the screen is moved to position B? _____ 12
 - if the screen is moved to position C? _____ 12
- Of the light energy that passes through the opening, what fraction strikes
 - of the screen at position A? _____ 13
 - of the screen at position B? _____ 13
 - of the screen at position C? _____ 13
- State a rule that describes the relationship between light brightness and distance. _____ 14

color

24

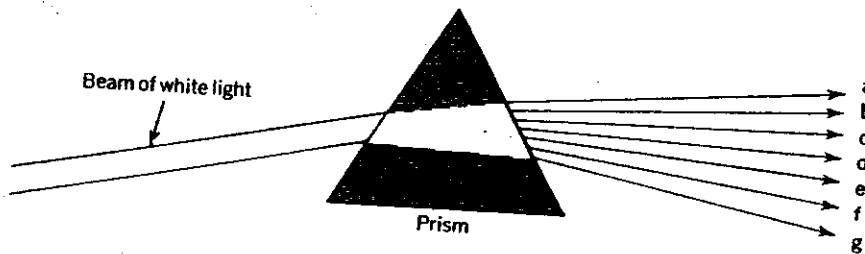
DIRECTIONS: Match each item in the right column with the letter of the best response in the left column.

- a. Result of intensive viewing
- b. Low frequency
- c. Responsible for tanning
- d. Highly penetrating
- e. Heat rays
- f. Spectroscope
- g. Reflects no light
- h. Reflects all light
- i. Shift in frequency
- j. Complementary colors

- Red and cyan () 1.
- Ultraviolet rays () 2.
- Infrared rays () 3.
- Retinal fatigue () 4.
- Long wavelength () 5.
- White () 6.
- Black () 7.
- X rays () 8.
- Diffraction grating () 9.
- Doppler effect () 10.

DIRECTIONS: Questions 11-17 relate to Fig. 24-1. In the blanks at the right of the diagram, list in the correct order the colors that result when white light is passed through a prism.

Fig. 24-1



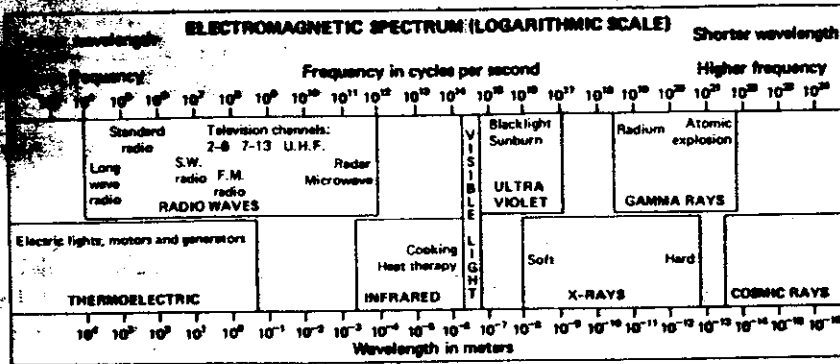
- _____ 11.
- _____ 12.
- _____ 13.
- _____ 14.
- _____ 15.
- _____ 16.
- _____ 17.

DIRECTIONS: Write the answers to the following questions in the spaces provided.

- 18. A primary color is one that cannot be produced by mixing together other colors. What are the primary colors of ^{pigments} paint? _____ 18.
- 19. What are the primary colors of light? _____ 19.
- 20. What color results when you mix together the three primary colors of pigments? _____ 20.
- 21. What color results when you mix together the three primary colors of light? _____ 21.
- 22. If powdered yellow pigment and blue pigments are mixed together, what color results? _____ 22.
- 23. When white light shines on red paper, what color(s) is (are) absorbed? _____ 23.
- 24. In Question 23, what color(s) is (are) reflected? _____ 24.
- 25. Does the light beam from a laser spread apart into a wider band when passing through a prism? Explain. _____ 25.

DIRECTIONS: Questions 26–29 relate to Fig. 24-2, which shows the electromagnetic spectrum. Answer each question in the space provided.

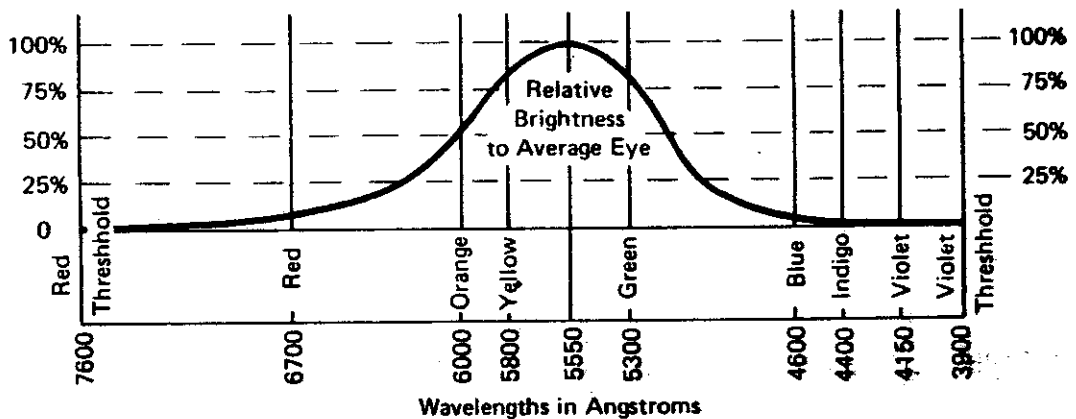
Fig. 24-2



26. Which of the following is likely to have a wavelength of 1 m? (a) SW radio; (b) FM radio; (c) infrared; (d) radar; (e) all _____ 26.
27. Which of the following waves has the highest frequency? (a) SW radio; (b) FM radio; (c) TV channels 2-6; (d) TV channels 7-13; (e) UHF _____ 27.
28. How many times longer is one wavelength of FM than one wavelength of UHF? (a) 2; (b) 8; (c) 10; (d) 100; (e) 1000 _____ 28.
29. How many times greater is the frequency of radium than the frequency of visible light? (a) 10; (b) 100; (c) 1000; (d) 10,000; (e) 100,000 _____ 29.

DIRECTIONS: The eye cannot see all the colors of the visible spectrum equally well. Study Fig. 24-3 and answer questions 30–35. Note: Ten million Angstroms equal a distance of one millimeter.

Fig. 24-3



30. What is the wavelength of the most visible light? _____ 30.
31. Does the red or violet end of the spectrum have longer waves? _____ 31.
32. Does the red or violet end of the spectrum have the greater frequency? _____ 32.
33. How many waves of red light are there in 1 nm? (a) 1400; (b) 1800; (c) 2100; (d) 2400; (e) 2700 _____ 33.
34. Explain why school buses are painted yellow. _____ 34.
35. Fire engines were traditionally painted red. Many communities now are changing to white. Can you explain why? _____ 35.

9-1: LIGHT AND COLOR**SECTION REVIEW**

MULTIPLE CHOICE: In the space provided, write the letter for the word or expression that best completes each statement.

- _____ 1. As light passes from air into glass,
a. its speed changes. b. rays with high frequencies are bent the least.
c. rays with low frequencies are bent the most.
d. the wavelengths are spread out according to how much they are reflected.
- _____ 2. A beam of light made up almost completely of a single frequency is produced by a(n)
a. fluorescent lamp. b. laser. c. incandescent bulb. d. red neon sign.
- _____ 3. The sky appears blue because
a. blue wavelengths of light pass through the atmosphere more easily due to their high frequency.
b. atmospheric particles refract blue wavelengths.
c. atmospheric particles reflect and scatter blue wavelengths of light.
d. atmospheric particles act like tiny prisms which bend blue wavelengths of light the most.
- _____ 4. The color found at the top of a rainbow is
a. red. b. green. c. violet. d. blue.
- _____ 5. The passage of an electric current through a gas produces visible light in all of the following except
a. an incandescent bulb. b. a laser. c. a neon light.
d. a mercury vapor lamp.
- _____ 6. A band of colors called the visible spectrum can be produced by rays of light passing through
a. neon gas. b. mercury vapor. c. a convex lens. d. a prism.
- _____ 7. The light source warmest to the touch is a(n)
a. fluorescent lamp. b. incandescent bulb. c. neon light.
d. sodium vapor lamp.
- _____ 8. The wavelength of light refracted the least by a prism is
a. red. b. orange. c. violet. d. ultraviolet.
- _____ 9. A laser beam would be least useful for
a. conducting light great distances. b. illuminating a room.
c. performing delicate surgery. d. producing a light show.
- _____ 10. When light passes through a prism, the wavelengths refracted most are
a. blue. b. green. c. red. d. violet.

CHAPTER 3

SECTION 3-1 SECTION REVIEW (continued)

FILL IN: Fill in each blank with the term or phrase that best completes the sentence. Not all the terms will be used.

coherent luminous bodies hologram
 fluorescent photograph temperature

- The color given off by an incandescent material depends upon the _____ of the heated material.
- The sun, stars, and lightbulbs are called _____ because they produce visible light.
- A _____ lamp produces light when ultraviolet rays strike a coating on the inside of the lamp.
- An intense beam of light made up mostly of one frequency of waves that are "in step" is said to be _____.
- A _____ is a three-dimensional image that is made by using laser light.

Application

- Compare various light sources by filling in the chart below.

LIGHT SOURCE	HOW LIGHT IS PRODUCED	COLOR OF LIGHT
		Color depends upon temperature of heated material
	Electricity passing through sodium vapor	
		red
	Coating on inside of lamp stricken by ultraviolet rays from mercury vapor	
Mercury vapor lamp		

- Which type of light is most economical to use to illuminate streets and highways?

- What is an advantage to using fluorescent lighting to illuminate a classroom?

- Which type of outdoor lighting would be least likely to cause light pollution?

CHAPTER 9: COLOR

9-2: SEEING COLOR

SECTION REVIEW

MATCHING. Match each description in the right-hand column with the correct term in the left-hand column. Place the letter of the description in the space provided.

- | | |
|---------------------------------|--|
| _____ 1. black | a. colors produced when reflected light waves combine to strengthen or cancel each other out |
| _____ 2. black, yellow and cyan | b. complementary colors of the American flag |
| _____ 3. | c. color of an object when all the colors of the spectrum are reflected |
| _____ 4. chromatography | d. color produced when blue and yellow paints are mixed |
| _____ 5. complementary colors | e. primary colors of light |
| _____ 6. gray | f. two colors of light that combine to produce white |
| _____ 7. green | g. chemical process used to separate materials |
| _____ 8. interference colors | h. color seen when a green-blind person views a green object |
| _____ 9. red, green, and blue | i. primary pigment colors |
| _____ 10. white | j. what an object looks like when it absorbs all the colors of the spectrum |

MULTIPLE CHOICE: In the space provided, write the letter for the word or expression that best completes each statement or answers the question.

- _____ 1. If a red light shines on a green object, the object appears
a. green. b. red. c. black. d. white.
- _____ 2. Of the following colors, which one is not used in reproducing color prints, such as those found in your textbook?
a. ~~blue~~ b. magenta c. yellow d. red
- _____ 3. A ridged surface, such as a diffraction grating, separates light by
a. absorption. b. reflection. c. interference. d. refraction.
- _____ 4. When paints are mixed, most colors are
a. reflected. b. absorbed. c. refracted. d. diffracted.
- _____ 5. Of the following, which are not complementary colors?
a. red and cyan b. red and blue c. yellow and blue
d. green and magenta
- _____ 6. A banana appears yellow because green and red wavelengths of light are
a. reflected. b. refracted. c. absorbed. d. diffracted.

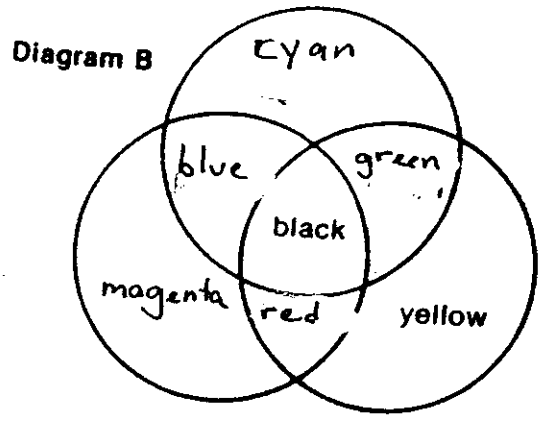
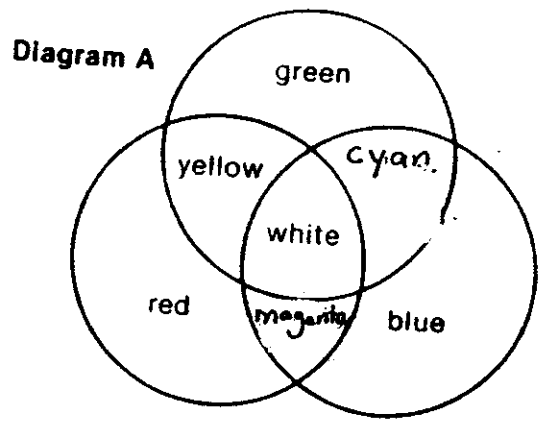
SECTION 9-2 SECTION REVIEW continued

FILL IN: Fill in each blank with the term that best completes the sentence. Not all the terms will be used.

- absorbed
- black
- reflected
- white
- yellow

1. When the primary colors of ^{pigments} paint are mixed, the color _____ is produced.
2. When the special cells in the eyes, called cones, receive the primary colors red and green, the brain interprets the message as the color _____.
3. When the primary colors of light are mixed, _____ light is produced.
4. When a red object is viewed, all of the colors except red are _____ by the object.

Application



1. Which of the diagrams above shows the primary colors of light and their combinations?

2. What does the other diagram represent? _____
3. Which diagram includes the primary colors used to print a color picture?

4. Which diagram includes the primary colors used to generate colors on a television screen?

5. Explain why the answers to questions 3 and 4 are different. _____

