Name _____ Class _____ Date _____

Exercises

28.1 The Color Spectrum (pages 555–556)

1. Isaac Newton was the first person to do a systematic study of color.
2. Circle the letter of each statement that is true about Newton's study of color.
   (a.) He studied sunlight.
   (b.) He passed sunlight through triangular-shaped pieces of glass.
   (c.) He observed that sunlight was broken into a rainbow-like pattern of colors.
   d. He showed that sunlight is yellow light.
3. A spread of colors is called a spectrum.
4. List the colors of the visible spectrum in the correct order.
   red, orange, yellow, green, blue, violet
5. Is the following sentence true or false? Sunlight is a combination of all colors. true
6. A white object appears white when illuminated by white light.
7. Explain this statement: White and black are not actually colors.
   White is not a color, but is a combination of all colors. Black is not a color; it is the absence of all light.
8. Is the following sentence true or false? Black objects that you can see absorb all light that falls on them. false

28.2 Color by Reflection (pages 556–558)

9. Circle the letter that best describes the color of an opaque object.
   a. An opaque object is the color it absorbs.
   b. An opaque object is the color of the light that shines on it.
   (c.) An opaque object is the color it reflects.
   d. An opaque object is the color of white light.
10. Different materials have different natural frequencies for absorbing and emitting radiation.
11. Describe what happens when the frequency of the light shining on an object resonates with the object's natural frequency.
    The object absorbs the light.
12. Describe what happens when the frequency of the light shining on an object is higher or lower than the object's natural frequency.
    The object reemits the light.
13. Is the following sentence true or false? When an object reemits the light that shines on it, absorption occurs. false

14. Circle the letter that best explains why cells containing chlorophyll are green.

a. They absorb green light.

b. They produce food.

(c.) They reflect green light.

d. They are very small.

15. Is the following sentence true or false? Different sources of light produce light made up of different frequencies. true

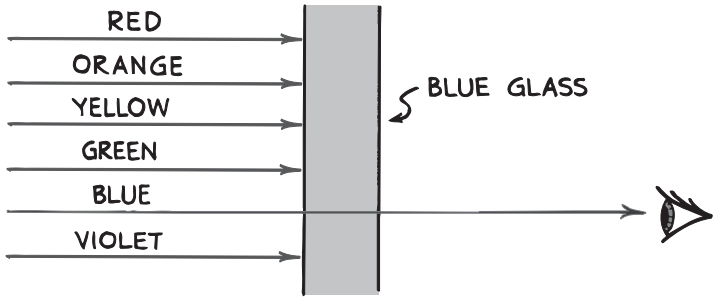
28.3 Color by Transmission (page 558)

16. What determines the color of a transparent object?

A transparent object is the color of the light it transmits.

17. The illustration below shows what happens when sunlight shines on a piece of blue glass. Describe what happens to the sunlight as it passes through the glass.

The glass transmits primarily the blue light and absorbs the other colors that illuminate it.



18. A pigment is a material in glass that selectively absorbs colored light.

19. Circle the letter that explains what the energy from the light absorbed by a piece of glass does to the glass.

a. The energy hardens the glass.

(b.) The energy warms the glass.

c. The energy darkens the glass.

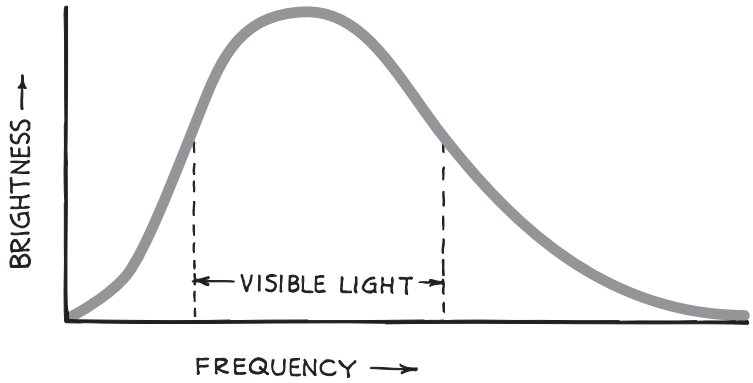
d. The energy has no effect on the glass.

28.4 Sunlight (page 559)

20. Is the following sentence true or false? Human vision is most sensitive to colors in the red-orange part of the visible spectrum. false

21. The graphical distribution of brightness versus frequency in sunlight is called the radiation curve.

Use the graph of brightness versus frequency of sunlight to answer Questions 22 and 23.



22. Is the following sentence true or false? The brightness of sunlight is directly proportional to frequency. false

23. What is the brightest portion of the spectrum of sunlight?
the middle of the visible range or the yellow-green region

28.5 Mixing Colored Light (pages 560–561)

24. What color of light is produced when red, blue, and green light of equal brightness overlap? white light.

Match the name of each color of light to the mixture of colors that produces it.

Color of Light	Mixtures That Produce the Color
b **25.** magenta	a. mixture of green and blue
c **26.** yellow	b. mixture of red and blue
a **27.** cyan	c. mixture of red and green

28. Is the following sentence true or false? By mixing red, blue, and green light and adjusting the brightness of each, virtually any color can be formed. true

29. Red, blue, and green light are known as the additive primary colors.

30. Explain how a color television produces a wide range of colors on its screen.
Groupings of spots of red, blue, and green cover the screen. By varying how much each colored spot is illuminated within each grouping, different colors are formed.

28.6 Complementary Colors (pages 562–563)

31. Two colors of light that when added together produce white are known as complementary colors.

Match each color in the left column with its complementary color in the right column.

	Color	Complementary Color
b	**32.** magenta	a. red
c	**33.** yellow	b. green
a	**34.** cyan	c. blue

35. Circle the letter that best describes the light that results when a color is subtracted from white light.

a. black

b. magenta

c. muddy brown

(d.) the complementary color to the subtracted color

28.7 Mixing Colored Pigments (pages 564–565)

36. Is the following sentence true or false? The mixing of colored paints yields similar results as mixing the same colors of light. false

37. Explain what happens when paints or dyes are mixed.

The mixture absorbs all the frequencies each paint absorbs.

38. What color(s) are absorbed by blue paint?

red, orange, and yellow

39. What color(s) are absorbed by yellow paint?

blue and violet

40. If white light shines on a mixture of blue and yellow paint, what color is not absorbed? green

41. The mixing of pigments, paints, or dyes is known as color mixing by subtraction.

42. Magenta, yellow, and cyan are the subtractive primary colors used in printing illustrations in full color.

43. Describe the process used to print a color image in a book.

Four different inks, magenta, yellow, cyan, and black, are used. Each color is printed on its own color plate. Each plate produces a series of ink dots on the page, the result of which gives the appearance of a wide range of colors.

28.8 Why the Sky Is Blue (pages 566–567)

44. Circle the letter of the process in which sound or light is absorbed and reemitted in all directions.

a. reflection
b. resonance
(c.) scattering
d. stimulated emission

45. Is the following sentence true or false? Atoms and molecules can behave like optical tuning forks, reemitting light waves that shine on them. true

46. Describe the relationship between the size of a particle in the atmosphere and the frequency of the light it scatters.
The tinier the particle, the higher the frequency of light it will scatter.

47. Is the following sentence true or false? The sky appears blue because particles in the atmosphere scatter low-frequency light. false

48. Although violet light is scattered more than blue light, our eyes see the sky as blue. Explain.
Our eyes are more sensitive to blue light than to violet light, so we see the sky as blue.

49. Circle the letter that describes what occurs when many particles larger than oxygen and nitrogen molecules are in the atmosphere.

a. The sky appears darker blue.
b. The sky appears black.
(c.) The sky appears whitish.
d. The sky appears green.

50. Is the following sentence true or false? The presence of water droplets in the atmosphere does not affect how much light is scattered or what frequencies of light are scattered. false

51. Explain why many clouds appear white.
They contain water droplets with a wide range of sizes. These droplets scatter a wide range of frequencies to produce a white-looking cloud.

52. A cloud containing many large water droplets appears dark.

28.9 Why Sunsets Are Red (pages 568–569)

53. Circle the letter of the color of light that is scattered the least as it passes through the atmosphere.

(a.) red
b. orange
c. yellow
d. blue

54. Is the following sentence true or false? At sunset, light reaches Earth's surface through a shorter path than at noon. false

55. As the path of sunlight through the atmosphere increases, what color of light is scattered more? blue

56. Describe how the color of the sky changes as more and more high frequency light is scattered.
The sky becomes progressively redder, going from yellow to orange.

57. Is the following sentence true or false? At sunset, only lower-frequency light strikes Earth. true

58. Is the following sentence true or false? The amount of scattering that occurs at sunset varies very little from day to day. false

28.10 Why Water Is Greenish Blue (pages 570–571)

59. Is the following sentence true or false? The deep-blue color of a pond or an ocean is due to the color of the water itself. false

60. Is the following sentence true or false? Water is transparent to nearly all the frequencies of white light. true

61. Circle the letter of the color(s) that water molecules absorb.

(a.) red b. green
c. blue d. all

62. Water molecules absorb certain frequencies of colored light. Circle the letter of the complementary color to the color that is absorbed.

a. magenta b. yellow
(c.) cyan d. white

28.11 The Atomic Color Code—Atomic Spectra (pages 571–573)

63. Is the following sentence true or false? When made to emit light, each element has its own unique color. true

64. What determines the colors emitted by an atom?
the energy levels of its electrons

65. An energy level greater than an atom's lowest energy state is known as an excited state.

66. After reaching an excited state, an atom emits a(n) photon and then returns to its normal state.

67. How is the frequency of a photon related to the energy change in an atom?
Frequency is directly proportional to the energy change.

68. What is a spectroscope?
an instrument used to analyze the light emitted by glowing elements

69. Is the following sentence true or false? The spectrum emitted by an excited atom is continuous. false

70. What does each line in a line spectrum represent?
Each line corresponds to a distinct frequency of light emitted by the atom.