Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Semester II Review 2013

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 1. Which of the following has the greatest momentum?
a. truck with a mass of 2250 kg moving at a velocity of 25 m/s
b. car with a mass of 1210 kg moving at a velocity of 51 m/s
c. truck with a mass of 6120 kg moving at a velocity of 10 m/s
d. car with a mass of 1540 kg moving at a velocity of 38 m/s

____ 2. When comparing the momentum of two moving objects, which of the following is correct?
a. The object with the higher velocity will have less momentum if the masses are equal.
b. The more massive object will have less momentum if its velocity is greater.
c. The less massive object will have less momentum if the velocities are the same.
d. The more massive object will have less momentum if the velocities are the same.

____ 3. A baseball is pitched very fast. Another baseball of equal mass is pitched very slowly. Which of the following statements is correct?
a. The fast-moving baseball is harder to stop because it has more momentum.
b. The slow-moving baseball is harder to stop because it has more momentum.
c. The fast-moving baseball is easier to stop because it has more momentum.
d. The slow-moving baseball is easier to stop because it has more momentum.

____ 4. A 6.0×10^{-2} kg tennis ball moves at a velocity of 12 m/s. The ball is struck by a racket, causing it to rebound in the opposite direction at a speed of 18 m/s. What is the change in the ball's momentum?
a. –0.38 kg•m/s
b. –0.72 kg•m/s
c. –1.1 kg•m/s
d. –1.8 kg•m/s

____ 5. A ball with a momentum of 4.0 kg•m/s hits a wall and bounces straight back without losing any kinetic energy. What is the change in the ball's momentum?
a. 0.0 kg•m/s
b. –4.0 kg•m/s
c. 8.0 kg•m/s
d. –8.0 kg•m/s

____ 6. Which of the following statements properly relates the variables in the equation $\mathbf{F}\Delta t = \Delta\mathbf{p}$?
a. A large constant force changes an object's momentum over a long time interval.
b. A large constant force acting over a long time interval causes a large change in momentum.
c. A large constant force changes an object's momentum at various time intervals.
d. A large constant force does not necessarily cause a change in an object's momentum.

____ 7. A large moving ball collides with a small stationary ball. The momentum
a. of the large ball decreases, and the momentum of the small ball increases.
b. of the small ball decreases, and the momentum of the large ball increases.
c. of the large ball increases, and the momentum of the small ball decreases.
d. does not change for either ball.

____ 8. A rubber ball moving at a speed of 5 m/s hit a flat wall and returned to the thrower at 5 m/s. The magnitude of the momentum of the rubber ball
a. increased.
b. decreased.
c. remained the same.
d. was not conserved.

____ 9. Two objects with different masses collide and bounce back after an elastic collision. Before the collision, the two objects were moving at velocities equal in magnitude but opposite in direction. After the collision,
   a. the less massive object had gained momentum.
   b. the more massive object had gained momentum.
   c. both objects had the same momentum.
   d. both objects lost momentum.

____ 10. A soccer ball collides with another soccer ball at rest. The total momentum of the balls
   a. is zero.
   b. increases.
   c. remains constant.
   d. decreases.

____ 11. In a two-body collision,
   a. momentum is conserved.
   b. kinetic energy is conserved.
   c. neither momentum nor kinetic energy is conserved.
   d. both momentum and kinetic energy are conserved.

____ 12. The law of conservation of momentum states that
   a. the total initial momentum of all objects interacting with one another usually equals the total final momentum.
   b. the total initial momentum of all objects interacting with one another does not equal the total final momentum.
   c. the total momentum of all objects interacting with one another is zero.
   d. the total momentum of all objects interacting with one another remains constant regardless of the nature of the forces between the objects.

____ 13. Which of the following statements about the conservation of momentum is NOT correct?
   a. Momentum is conserved for a system of objects pushing away from each other.
   b. Momentum is not conserved for a system of objects in a head-on collision.
   c. Momentum is conserved when two or more interacting objects push away from each other.
   d. The total momentum of a system of interacting objects remains constant regardless of forces between the objects.

____ 14. An astronaut with a mass of 70.0 kg is outside a space capsule when the tether line breaks. To return to the capsule, the astronaut throws a 2.0 kg wrench away from the capsule at a speed of 14 m/s. At what speed does the astronaut move toward the capsule?
   a. 5.0 m/s
   b. 0.4 m/s
   c. 3.5 m/s
   d. 7.0 m/s

____ 15. A bullet with a mass of 5.00×10^{-3} kg is loaded into a gun. The loaded gun has a mass of 0.52 kg. The bullet is fired, causing the empty gun to recoil at a speed of 2.1 m/s. What is the speed of the bullet?
   a. 48 m/s
   b. 220 m/s
   c. 120 m/s
   d. 360 m/s

____ 16. Each croquet ball in a set has a mass of 0.50 kg. The green ball travels at 10.5 m/s and strikes a stationary red ball. If the green ball stops moving, what is the final speed of the red ball after the collision?
   a. 10.5 m/s
   b. 6.0 m/s
   c. 12.0 m/s
   d. 9.6 m/s

____ 17. Two objects move separately after colliding, and both the total momentum and total kinetic energy remain constant. Identify the type of collision.
   a. elastic
   b. perfectly elastic
   c. inelastic
   d. perfectly inelastic

____ 18. Two objects stick together and move with the same velocity after colliding. Identify the type of collision.
a. elastic
b. perfectly elastic
c. inelastic
d. perfectly inelastic

____ 19. Two balls of dough collide and stick together. Identify the type of collision.
a. elastic
b. perfectly elastic
c. inelastic
d. perfectly inelastic

____ 20. A 1.5×10^3 kg truck moving at 15 m/s strikes a 7.5×10^2 kg automobile stopped at a traffic light. The vehicles hook bumpers and skid together at 10.0 m/s. What is the decrease in kinetic energy?
a. 1.1×10^5 J
b. 1.2×10^4 J
c. 1.7×10^5 J
d. 6.0×10^4 J

____ 21. An infant throws 5 g of applesauce at a velocity of 0.2 m/s. All of the applesauce collides with a nearby wall and sticks. What is the decrease in kinetic energy of the applesauce?
a. 2×10^{-4} J
b. 0.5×10^{-4} J
c. 1×10^{-3} J
d. 1×10^{-4} J

____ 22. A billiard ball collides with a second identical ball in an elastic head-on collision. What is the kinetic energy of the system after the collision compared with the kinetic energy before the collision?
a. unchanged
b. one-fourth as great
c. two times as great
d. four times as great

____ 23. Which of the following best describes the momenta of two bodies after a two-body collision if the kinetic energy of the system is conserved?
a. must be less
b. must also be conserved
c. might also be conserved
d. is doubled in value

____ 24. A bowling ball with a mass of 7.0 kg strikes a pin that has a mass of 2.0 kg. The pin flies forward with a velocity of 6.0 m/s, and the ball continues forward at 4.0 m/s. What was the original velocity of the ball?
a. 4.0 m/s
b. 5.7 m/s
c. 6.6 m/s
d. 3.3 m/s

____ 25. A 90 kg halfback runs north and is tackled by a 120 kg opponent running south at 4 m/s. The collision is perfectly inelastic. Just after the tackle, both players move at a velocity of 2 m/s north. Calculate the velocity of the 90 kg player just before the tackle.
a. 3 m/s south
b. 4 m/s south
c. 10 m/s north
d. 12 m/s north

____ 26. A substance's temperature increases as a direct result of
a. energy being removed from the particles of the substance.
b. kinetic energy being added to the particles of the substance.
c. a change in the number of atoms and molecules in a substance.
d. a decrease in the volume of the substance.

____ 27. What happens to the internal energy of an ideal gas when it is heated from 0°C to 4°C?
a. It increases.
b. It decreases.
c. It remains constant.
d. It is impossible to determine.

____ 28. Which of the following is proportional to the kinetic energy of atoms and molecules?
a. elastic energy
b. temperature
c. potential energy
d. thermal equilibrium

____ 29. What is the temperature of a system in thermal equilibrium with another system made up of ice and water at 1 atm of pressure?
a. 0°F
b. 273 K
c. 0 K
d. 100°C

____ 30. If two small beakers of water, one at 70°C and one at 80°C, are emptied into a large beaker, what is the final temperature of the water?
a. less than 70°C
b. greater than 80°C
c. between 70°C and 80°C
d. The water temperature will fluctuate.

____ 31. If 546 K equals 273°C, then 500 K equals
a. 227°C.
b. 250°C.
c. 773°C.
d. 1000°C.

____ 32. A substance registers a temperature change from 20°C to 40°C. This corresponds to an incremental change of
a. 20°F.
b. 40°F.
c. 36°F.
d. 313°F.

____ 33. A substance registers a temperature change from 20°C to 40°C. This corresponds to an incremental change of
a. 20 K.
b. 40 K.
c. 36 K.
d. 313 K.

____ 34. The average normal body temperature for human beings is 98.6°F. This corresponds to which of the following in degrees Kelvin?
a. 296 K
b. 310 K
c. 393 K
d. 273 K

____ 35. If energy is transferred from a table to a block of ice moving across the table, which of the following statements is true?
a. The table and the ice are at thermal equilibrium.
b. The ice is cooler than the table.
c. The ice is no longer 0°C.
d. Energy is being transferred from the ice to the table.

____ 36. Why does sandpaper get hot when it is rubbed against rusty metal?
a. Energy is transferred from the sandpaper into the metal.
b. Energy is transferred from the metal to the sandpaper.
c. Friction is creating the heat.
d. Energy is transferred from a hand to the sandpaper.

____ 37. High temperature is related to
a. low kinetic energy.
b. high kinetic energy.
c. no difference in kinetic energy.
d. zero net energy.

____ 38. A 5.00×10^2 kg object is attached by a rope through a pulley to a paddle-wheel shaft that is placed in a well-insulated tank holding 25.0 kg of water. The object is allowed to fall, causing the paddle wheel to rotate, churning the water. If the object falls a vertical distance of 1.00×10^2 m at constant speed, what is the temperature change of the water? (c_p = 4186 J/kg•°C and g = 9.81 m/s^2)
a. 1.96×10^4°C
b. 4.69×10^3°C
c. 4.69°C
d. 0.800°C

____ 39. What is the temperature increase of water per kilogram at the bottom of a 145 m waterfall if all of the initial potential energy is transferred as heat to the water? (g = 9.81 m/s^2 and c_p = 4186 J/kg•°C)
a. 0.170°C
b. 0.340°C
c. 0.680°C
d. 1.04°C

____ 40. What is the temperature increase of 4.0 kg of water when it is heated by an 8.0×10^2 W immersion heater for exactly 10.0 min? (c_p = 4186 J/kg•°C)
a. 57°C
b. 51°C
c. 29°C
d. 14°C

____ 41. Which of two rods has the greatest thermal conductivity?
a. a rod with electrons that are freer to move from atom to atom than are the electrons another rod
b. a rod with greater specific heat than another rod
c. a rod with greater cross-sectional area than another rod
d. a rod with greater length than another rod

____ 42. A 0.20 kg aluminum plate with an initial temperature of 20.0°C slides down a 15 m long surface that is inclined at a 30.0° angle to the horizontal. The force of kinetic friction exactly balances the component of gravity down the plane so that the plate, once started, glides down at constant velocity. If 90.0 percent of the mechanical energy of the system is absorbed by the aluminum, what is the temperature increase of the plate when it is at the bottom of the incline? ($c_a = 9.00 \times 10^2$ J/kg•°C)
a. 0.16°C
b. 7.2×10^{-2}°C
c. 4.2×10^{-2}°C
d. 3.1×10^{-2}°C

____ 43. A 1.00×10^2 g piece of copper at an initial temperature of 95°C is dropped into 2.00×10^2 g of water contained in a 0.28 kg aluminum calorimeter. The water and calorimeter are initially at 15°C. What is the final temperature of the system when it reaches equilibrium? ($c_c = 3.9 \times 10^2$ J/kg•°C and $c_a = 9.00 \times 10^2$ J/kg•°C.)
a. 16°C
b. 18°C
c. 24°C
d. 25°C

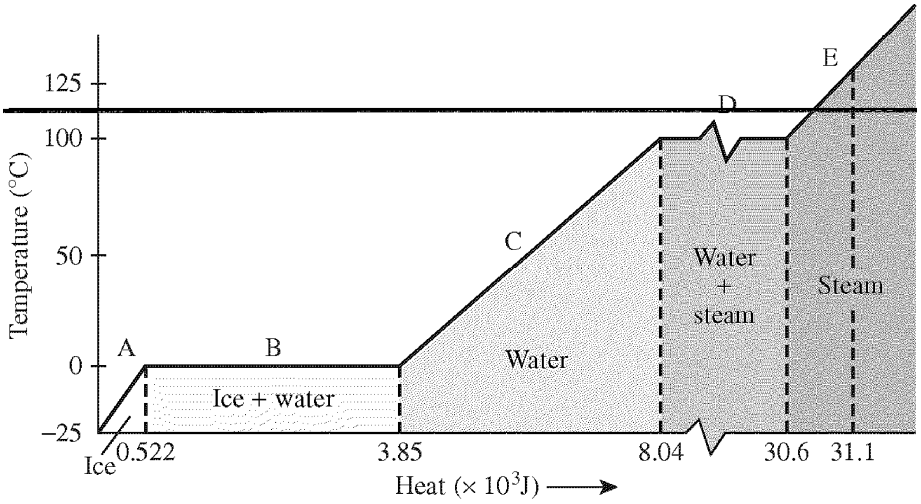
____ 44. Find the final equilibrium temperature when 10.0 g of milk at 10.0°C is added to 1.60×10^2 g of coffee with a temperature of 90.0°C. Assume the specific heats of coffee and milk are the same as for water ($c_w = 4.19$ J/g•°C), and disregard the heat capacity of the container.
a. 85.3°C
b. 77.7°C
c. 71.4°C
d. 66.7°C

____ 45. A slice of bread contains about 4.19×10^5 J of energy. If the specific heat of a person is 4.19×10^3 J/kg•°C, by how many degrees Celsius would the temperature of a 70.0 kg person increase if all the energy in the bread were converted to heat?
a. 2.25°C
b. 1.86°C
c. 1.43°C
d. 1.00°C

____ 46. A flat container holds 200 g of water. Over a 10 min period, 1.5 g of water evaporates from the surface. What is the approximate temperature change of the remaining water? ($L_v = 2.26 \times 10^3$ J/g)
a. 4°C
b. –4°C
c. 0.4°C
d. –0.4°C

____ 47. A pitcher of iced tea is made by adding ice to 1.8 kg of hot tea with an initial temperature of 80.0°C. How many kilograms of ice, which has an initial temperature of 0.0°C, are required to bring the mixture to 10.0°C? ($L_f = 3.3 \times 10^5$ J/kg)
a. 1.8 kg
b. 1.6 kg
c. 1.4 kg
d. 1.2 kg

____ 48. A 1.0 kg cube of ice is dropped into 1.0 kg of water, and, when equilibrium is reached, there are 2.0 kg of ice at 0.0°C. The initial temperature of the water was 0°C. What was the original temperature of the ice? ($c_w = 4186$ J/kg•°C, $c_i = 2093$ J/kg•°C, and $L_f = 3.3 \times 10^5$ J/kg•°C)
a. one or two degrees below 0.0°C
b. –80°C
c. –160°C
d. –240°C



____ 49. At what point on the figure above is the amount of energy transferred as heat approximately 4.19×10^3 J?
a. A
b. B
c. C
d. D

____ 50. At what point on the figure above does the substance undergo a phase change?
a. A
b. B
c. C
d. E

____ 51. Which of the following is a substance in which the temperature and pressure remain constant while the substance experiences an inward transfer of energy?
a. gas
b. liquid
c. solid
d. substance undergoing a change of state

____ 52. On a sunny day at the beach, the reason the sand gets hot and the water stays relatively cool is attributed to the difference in which property between water and sand?
a. mass density
b. specific heat
c. temperature
d. thermal conductivity

____ 53. Tripling the displacement from equilibrium of an object in simple harmonic motion will change the magnitude of the object's maximum acceleration by what factor?
a. one-third
b. 1
c. 3
d. 9

____ 54. A mass attached to a spring vibrates back and forth. At maximum displacement, the spring force and the
a. velocity reach a maximum.
b. velocity reach zero.
c. acceleration reach a maximum.
d. acceleration reach zero.

____ 55. How much displacement will a coil spring with a spring constant of 120 N/m achieve if it is stretched by a 60 N force?
a. –0.5 m
b. –2 m
c. –4 m
d. –7000 m

____ 56. A mass on a spring that has been compressed 0.1 m has a restoring force of 20 N. What is the spring constant?
a. 10 N/m
b. 20 N/m
c. 200 N/m
d. 300 N/m

____ 57. The angle between the string of a pendulum at its equilibrium position and at its maximum displacement is its
a. period.
b. frequency.
c. vibration.
d. amplitude.

____ 58. A child on a playground swings through a total of 32°. If the displacement is equal on each side of the equilibrium position, what is the amplitude of this vibration? (Disregard frictional forces acting on the swing.)
a. 8.0°
b. 16°
c. 32°
d. 64°

____ 59. Imagine that you could transport a simple pendulum from Earth to the moon, where the free-fall acceleration is one-sixth that on Earth. By what factor would the pendulum's frequency be changed?
a. almost 6.0
b. almost 2.5
c. almost 0.4
d. almost 0.17

____ 60. On the planet Xenos, an astronaut observes that a 1.00 m long pendulum has a period of 1.50 s. What is the free-fall acceleration on Xenos?
a. 4.18 m/s^2
b. 10.2 m/s^2
c. 17.5 m/s^2
d. 26.3 m/s^2

____ 61. Which of the following is a wave whose source is some form of repeating motion?
a. pulse wave
b. periodic wave
c. sine wave
d. transverse wave

____ 62. One end of a taut rope is fixed to a post. What type of wave is demonstrated if the free end is quickly raised and lowered?
a. pulse wave
b. periodic wave
c. sine wave
d. transverse wave

____ 63. Two waves can occupy the same space at the same time because waves
a. are matter.
b. are displacements of matter.
c. do not cause interference patterns.
d. cannot pass through one another.

____ 64. The superposition of mechanical waves can be observed in the movement of
a. bumper cars.
b. waves in a ripple tank.
c. electromagnetic radiation.
d. an orchestra.

____ 65. What is the phase difference between two waves that are traveling in the same medium when they undergo constructive interference?
a. 270°
b. 180°
c. 90°
d. 0°

____ 66. Which of the following is the interference that results when individual displacements on the same side of the equilibrium position are added together to form the resultant wave?
a. constructive
b. destructive
c. complete constructive
d. complete destructive

____ 67. Which of the following is the interference that results when individual displacements on opposite sides of the equilibrium position are added together to form the resultant wave?
a. constructive
b. destructive
c. complete constructive
d. complete destructive

____ 68. Consider two identical wave pulses on a rope. Suppose the first pulse reaches the fixed end of the rope, is reflected back, and then meets the second pulse. When the two pulses overlap exactly, the superposition principle predicts that the amplitude of the resultant pulses at that moment will be what factor times the amplitude of one of the original pulses?

a. 0
b. 1
c. 2
d. 4

____ 69. Standing waves are produced by periodic waves of

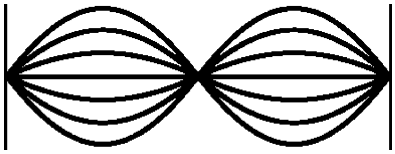
a. any amplitude and wavelength traveling in the same direction.
b. the same amplitude and wavelength traveling in the same direction.
c. any amplitude and wavelength traveling in opposite directions.
d. the same frequency, amplitude, and wavelength traveling in opposite directions.

____ 70. Which of the following wave lengths would produce standing waves on a string approximately 3.5 m long?

a. 2.33 m
b. 2.85 m
c. 3.75 m
d. 4.55 m

____ 71. Which of the following wavelengths would NOT produce standing waves on a rope whose length is 1 m?

a. 2/3 m
b. 1 m
c. 2 m
d. π m



____ 72. How many nodes and antinodes are shown in the standing wave above?

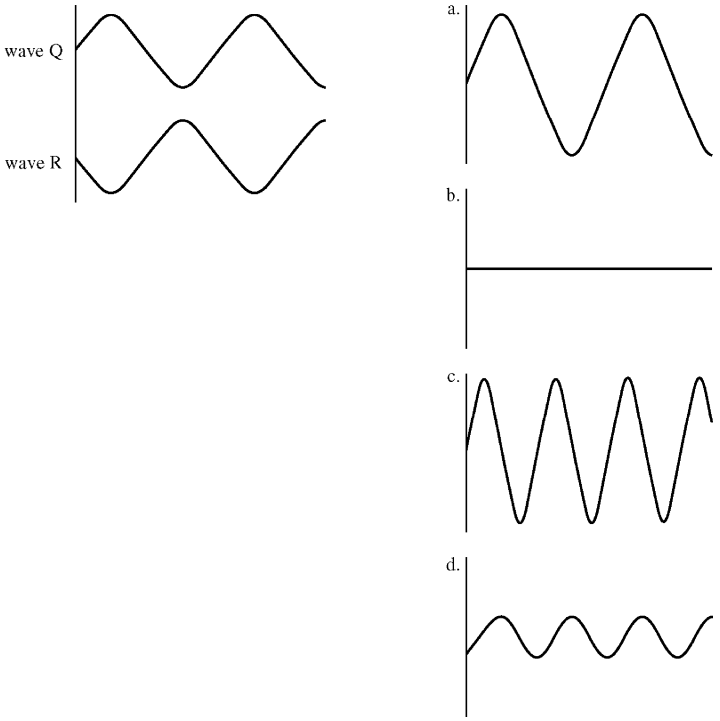
a. two nodes and three antinodes
b. one node and two antinodes
c. one-third node and one antinode
d. three nodes and two antinodes

____ 73. A 3.0 m long stretched string is fixed at both ends. If standing waves with a wavelength of two-thirds *L* are produced on this string, how many nodes will be formed?

a. 0
b. 2
c. 3
d. 4

____ 74. What is the fewest number of nodes a standing wave can have?

a. 1
b. 2
c. 3
d. 4



____ 75. In the diagram above, use the superposition principle to find the resultant wave of waves Q and R.
a. a
b. b
c. c
d. d

____ 76. Which portion of the electromagnetic spectrum is used in aircraft navigation?
a. infrared waves
b. microwaves
c. radio waves
d. ultraviolet light

____ 77. Which portion of the electromagnetic spectrum is used to sterilize medical instruments?
a. infrared waves
b. microwaves
c. X rays
d. ultraviolet light

____ 78. The relationship between frequency, wavelength, and speed holds for light waves because
a. light travels slower in a vacuum than in air.
b. all forms of electromagnetic radiation travel at a single speed in a vacuum.
c. light travels in straight lines.
d. different forms of electromagnetic radiation travel at different speeds.

____ 79. A highly polished finish on a new car provides a ____ surface for ____ reflection.
a. rough; diffused
b. specular; diffused
c. rough; regular
d. smooth; specular

____ 80. When a straight line is drawn perpendicular to a flat mirror at the point where an incoming ray strikes the mirror's surface, the angles of incidence and reflection are measured from the normal and
a. the angles of incidence and reflection are equal.
b. the angle of incidence is greater than the angle of reflection.
c. the angle of incidence is less than the angle of reflection.
d. the angle of incidence can be greater than or less than the angle of reflection.

____ 81. If a light ray strikes a flat mirror at an angle of 52° from the normal, the reflected ray will be
a. 52° from the normal.
b. 25° from the normal.
c. 90° from the mirror's surface.
d. 18° from the normal.

____ 82. If a light ray strikes a flat mirror at an angle of 61° from the normal, the reflected ray will be
a. 61° from the mirror's surface.
b. 27° from the normal.
c. 90° from the mirror's surface.
d. 61° from the normal.

____ 83. If a light ray strikes a flat mirror at an angle of 75° from the normal, the reflected ray will be
a. 63° from the mirror's surface.
b. 75° from the normal.
c. 90° from the mirror's surface.
d. 63° from the normal.

____ 84. When two parallel mirrors are placed so that their reflective sides face one another, ____ images form. This is because the image in one mirror becomes the ____ for the other mirror.
a. multiple; object
b. reduced; virtual image
c. inverted; center of curvature
d. enlarged; focal point

____ 85. If you stand 3.0 m in front of a flat mirror, how far away from you would your image be in the mirror?
a. 1.5 m
b. 3.0 m
c. 6.0 m
d. 12.0 m

____ 86. When the reflection of an object is seen in a flat mirror, the distance from the mirror to the image depends on
a. the wavelength of light used for viewing.
b. the distance from the object to the mirror.
c. the distance of both the observer and the object to the mirror.
d. the size of the object.

____ 87. A concave mirror with a focal length of 10.0 cm creates a real image 30.0 cm away on its principal axis. How far from the mirror is the corresponding object?
a. 20.0 cm
b. 15.0 cm
c. 7.50 cm
d. 5.00 cm

____ 88. A concave mirror forms a real image at 25 cm from the mirror surface along the principal axis. If the corresponding object is at a 10.0 cm distance, what is the mirror's focal length?
a. 1.4 cm
b. 17 cm
c. 12 cm
d. 7.1 cm

____ 89. A concave mirror forms a real image at 14 cm from the mirror surface along the principal axis. If the corresponding object is at a 29 cm distance, what is the mirror's focal length?
a. 14 cm
b. 9.4 cm
c. 12 cm
d. 36 cm

____ 90. A concave mirror forms a real image at 17 cm from the mirror surface along the principal axis. If the corresponding object is at a 36 cm distance, what is the mirror's focal length?
a. 19 cm
b. 47 cm
c. 12 cm
d. 26 cm

____ 91. A concave mirror forms a real image at 42 cm from the mirror surface along the principal axis. If the corresponding object is at a 88 cm distance, what is the mirror's focal length?
a. 28 cm
b. 17 cm
c. 12 cm
d. 9 cm

____ 92. If a virtual image is formed 10.0 cm along the principal axis from a convex mirror with a focal length of –15.0 cm, what is the object's distance from the mirror?
a. 30.0 cm
b. 12 cm
c. 6.0 cm
d. 3.0 cm

____ 93. Which best describes the image of a concave mirror when the object is located somewhere between the focal point and twice the focal-point distance from the mirror?
a. virtual, upright, and magnification greater than one
b. real, inverted, and magnification less than one
c. virtual, upright, and magnification less than one
d. real, inverted, and magnification greater than one

____ 94. Which best describes the image of a concave mirror when the object's distance from the mirror is less than the focal-point distance?
a. virtual, upright, and magnification greater than one
b. real, inverted, and magnification less than one
c. virtual, upright, and magnification less than one
d. real, inverted, and magnification greater than one

____ 95. When the reflection of an object is seen in a flat mirror, the image is
a. real and upright.
b. real and inverted.
c. virtual and upright.
d. virtual and inverted.

____ 96. Which of the following is NOT an additive primary color?
a. yellow
b. blue
c. red
d. green

____ 97. What color does blue pigment subtract from white light?
a. blue
b. red
c. violet
d. green

____ 98. A wave on a rope approaches two gratings in a row. The wave is polarized parallel to grating 1 and perpendicular to grating 2. The wave passes through
a. only grating 1.
b. only grating 2.
c. both gratings.
d. neither grating.

____ 99. As the angle is between the electric-field waves and the transmission axis increases,
a. the component of light that passes through the polarizer decreases and the brightness of the light decreases.
b. the component of light that passes through the polarizer decreases and the brightness of the light increases.
c. the component of light that passes through the polarizer increases and the brightness of the light decreases.
d. the component of light that passes through the polarizer increases and the brightness of the light increases.

____ 100. If you looked at a light through the lenses from two polarizing sunglasses that were overlapped at right angles to one another,
a. all of the light would pass through.
b. most of the light would pass through.
c. little of the light would pass through.
d. none of the light would pass through.