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

Cp physics - Spring Final Review (second semester topics)

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. Which of the following is a direct cause of a substance's temperature increase?
a. Energy is removed from the particles of the substance.
b. Kinetic energy is added to the particles of the substance.
c. The number of atoms and molecules in a substance changes.
d. The volume of the substance decreases.

____ 2. 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.

____ 3. 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

____ 4. As the temperature of a substance increases, its volume tends to increase due to
a. thermal equilibrium.
b. thermal energy.
c. thermal expansion.
d. thermal contraction.

____ 5. What is the temperature of a system in thermal equilibrium with another system made up of water and steam at 1 atm of pressure?
a. 0°F
b. 273 K
c. 0 K
d. 100°C

____ 6. Energy transferred as heat occurs between two bodies in thermal contact when they differ in which of the following properties?
a. mass
b. specific heat
c. density
d. temperature

____ 7. Which of the following terms describes a transfer of energy?
a. heat
b. internal energy
c. temperature
d. kinetic energy

____ 8. The use of fiberglass insulation in the outer walls of a building is intended to minimize heat transfer through what process?
a. conduction
b. radiation
c. convection
d. vaporization

____ 9. How is energy transferred as heat always directed?
a. from an object at low temperature to an object at high temperature
b. from an object at high temperature to an object at low temperature
c. from an object at low kinetic energy to an object at high kinetic energy
d. from an object with higher mass to an object of lower mass

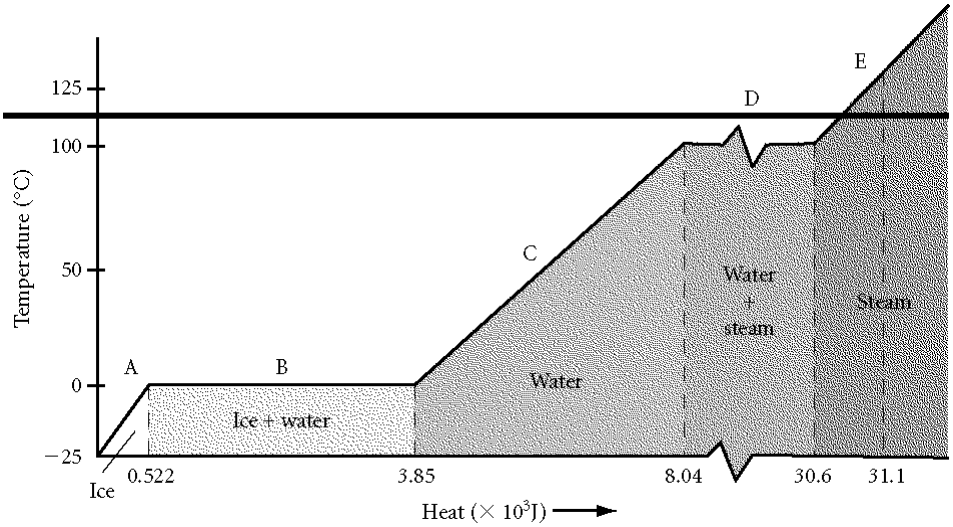
____ 10. What three properties of a substance affect the amount of energy transferred as heat to or from the substance?
a. volume, temperature change, specific heat capacity
b. density, temperature change, specific heat capacity
c. mass, temperature change, specific heat capacity
d. mass, temperature change, latent heat

____ 11. A slice of bread contains about 4.19×10^5 J of energy. If the specific heat capacity 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
c. 1.43°C
b. 1.86°C
d. 1.00°C

____ 12. Which of the following is true during a phase change?

a. Temperature increases.
c. Temperature decreases.
b. Temperature remains constant.
d. There is no transfer of energy as heat.



____ 13. The figure above shows how the temperature of 10.0 g of ice changes as energy is added. Which of the following statements is correct?

a. The water absorbed energy continuously, but the temperature increased only when all of the water was in one phase.
b. The water absorbed energy sporadically, and the temperature increased only when all of the water was in one phase.
c. The water absorbed energy continuously, and the temperature increased continuously.
d. The water did not absorb energy.

____ 14. At what point on the figure above does the substance undergo a phase change?

a. A
c. C
b. B
d. E

____ 15. Using the figure above, determine which value equals the latent heat required to change the liquid water into steam.

a. 8.04×10^3 J
c. 30.6×10^3 J
b. 22.6×10^3 J
d. 31.1×10^3 J

____ 16. At what point on the figure above is the amount of energy transferred as heat approximately 4.19×10^3 J?

a. A
c. C
b. B
d. D

____ 17. When an ideal gas does positive work on its surroundings, which of the gas's quantities increases?
a. temperature
b. volume
c. pressure
d. internal energy

____ 18. An ideal gas system is maintained at a constant volume of 4 L. If the pressure is constant, how much work is done by the system?
a. 0 J
b. 5 J
c. 8 J
d. 30 J

____ 19. Which thermodynamic process takes place at a constant temperature so that the internal energy of a system remains unchanged?
a. isovolumetric
b. isobaric
c. adiabatic
d. isothermal

____ 20. Which thermodynamic process takes place at constant volume so that no work is done on or by the system?
a. isovolumetric
b. isobaric
c. adiabatic
d. isothermal

____ 21. In an isovolumetric process for an ideal gas, the system's change in the energy as heat is equivalent to a change in which of the following?
a. temperature
b. volume
c. pressure
d. internal energy

____ 22. How is conservation of internal energy expressed for a system during an adiabatic process?
a. $Q = W = 0$, so $\Delta U = 0$ and $U_i = U_f$
b. $Q = 0$, so $\Delta U = -W$
c. $\Delta T = 0$, so $\Delta U = 0$; therefore, $\Delta U = Q - W = 0$, or $Q = W$
d. $\Delta V = 0$, so $P\Delta V = 0$ and $W = 0$; therefore, $\Delta U = Q$

____ 23. How is conservation of internal energy expressed for a system during an isovolumetric process?
a. $Q = W = 0$, so $\Delta U = 0$ and $U_i = U_f$
b. $Q = 0$, so $\Delta U = -W$
c. $\Delta T = 0$, so $\Delta U = 0$; therefore, $\Delta U = Q - W = 0$, or $Q = W$
d. $\Delta V = 0$, so $P\Delta V = 0$ and $W = 0$; therefore, $\Delta U = Q$

____ 24. How is conservation of internal energy expressed for a system during an isothermal process?
a. $Q = W = 0$, so $\Delta U = 0$ and $U_i = U_f$
b. $Q = 0$, so $\Delta U = -W$
c. $\Delta T = 0$, so $\Delta U = 0$; therefore, $\Delta U = Q - W = 0$, or $Q = W$
d. $\Delta V = 0$, so $P\Delta V = 0$ and $W = 0$; therefore, $\Delta U = Q$

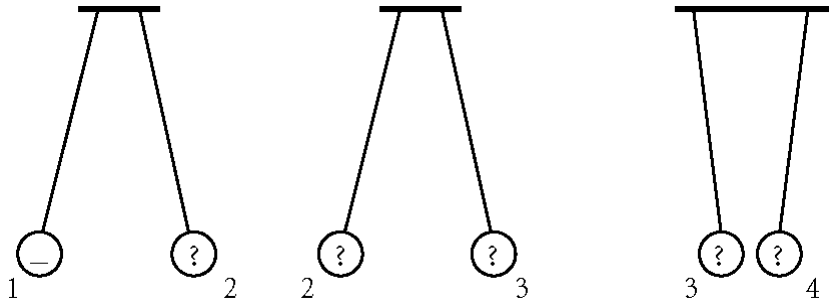
____ 25. An ideal gas system undergoes an adiabatic process in which it expands and does 20 J of work on its environment. What is the change in the system's internal energy?
a. –20 J
b. –5 J
c. 0 J
d. 20 J

____ 26. An ideal gas system undergoes an isovolumetric process in which 20 J of energy is added as heat to the gas. What is the change in the system's internal energy?
a. –20 J
b. 0 J
c. 5 J
d. 20 J

____ 27. A repelling force occurs between two charged objects when the charges are of
a. unlike signs.
b. like signs.
c. equal magnitude.
d. unequal magnitude.

____ 28. When a glass rod is rubbed with silk and becomes positively charged,
a. electrons are removed from the rod.
b. protons are removed from the silk.
c. protons are added to the silk.
d. the silk remains neutral.

____ 29. Charge is most easily transferred in
a. nonconductors.
b. conductors.
c. semiconductors.
d. insulators.



____ 30. In the diagram shown above, the circles represent small balls that have electric charges. Ball 1 has a negative charge, and ball 2 is repelled by ball 1. Next, you see that ball 2 repels ball 3 and that ball 3 attracts ball 4. What is the electric charge on ball 4?
a. Ball 4 may have either a positive or negative charge.
b. Ball 4 has a negative charge.
c. Ball 4 has a positive charge.
d. It is not possible to determine the charge on ball 4.

____ 31. The process of charging a conductor by bringing it near another charged object and then grounding the conductor is called
a. contact charging.
b. induction.
c. polarization
d. neutralization.

____ 32. Two point charges, initially 2 cm apart, are moved to a distance of 10 cm apart. By what factor does the resulting electric force between them change?
a. 25
b. 5
c. $\frac{1}{5}$
d. $\frac{1}{25}$

____ 33. Two positive charges, each of magnitude q, are on the y-axis at points $y = +a$ and $y = -a$. Where would a third positive charge of the same magnitude be located for the net force on the third charge to be zero?
a. at the origin
b. at $y = 2a$
c. at $y = -2a$
d. at $y = -a$

____ 34. Which is the *most* correct statement regarding the drawing of electric field lines?
a. Electric field lines always connect from one charge to another.
b. Electric field lines always form closed loops.
c. Electric field lines can start on a charge of either polarity.
d. Electric field lines never cross each other.

____ 35. The electric field just outside a charged conductor in electrostatic equilibrium is
a. zero.
b. at its minimum level.
c. the same as it is in the center of the conductor.
d. perpendicular to the conductor's surface.

____ 36. For a conductor that is in electrostatic equilibrium, any excess charge
a. flows to the ground.
b. resides entirely on the conductor's outer surface.
c. resides entirely on the conductor's interior.
d. resides entirely in the center of the conductor.

____ 37. Electric field strength depends on
a. charge and distance.
b. charge and mass.
c. Coulomb constant and mass.
d. elementary charge and radius.

____ 38. When a positive charge moves in the direction of the electric field, what happens to the electrical potential energy associated with the charge?
a. It increases.
b. It decreases.
c. It remains the same.
d. It sharply increases, and then decreases.

____ 39. Charge buildup between the plates of a capacitor stops when
a. there is no net charge on the plates.
b. unequal amounts of charge accumulate on the plates.
c. the potential difference between the plates is equal to the applied potential difference.
d. the charge on both plates is the same.

____ 40. A 0.25 μF capacitor is connected to a 9.0 V battery. What is the charge on the capacitor?
a. 1.2×10^{-12} C
b. 2.2×10^{-6} C
c. 2.5×10^{-6} C
d. 2.8×10^{-2} C

____ 41. A parallel-plate capacitor has a capacitance of *C* F. If the area of the plates is doubled while the distance between the plates is halved, the new capacitance will be
a. *4C*.
b. *2C*.
c. $\frac{C}{2}$.
d. $\frac{C}{4}$.

____ 42. A wire carries a steady current of 0.1 A over a period of 20 s. What total charge moves through the wire in this time interval?
a. 200 C
b. 20 C
c. 2 C
d. 0.005 C

____ 43. What is the potential difference across a 5.0 Ω resistor that carries a current of 5.0 A?
a. 1.0×10^{2} V
b. 25 V
c. 10.0 V
d. 1.0 V

____ 44. A flashlight bulb with a potential difference of 4.5 V across it has a resistance of 8.0 Ω. How much current is in the bulb filament?
a. 36 A
b. 9.4 A
c. 1.8 A
d. 0.56 A

____ 45. If a 75 W lightbulb operates at a voltage of 120 V, what is the current in the bulb?

a. 0.62 A
c. 1.95×10^2 A
b. 1.6 A
d. 9.0×10^3 A

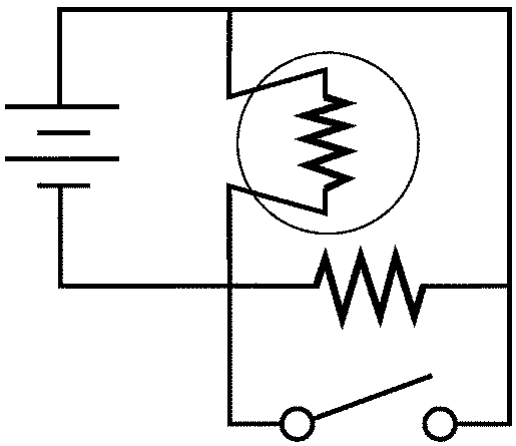
____ 46. Tripling the current in a circuit with constant resistance has the effect of changing the power by what factor?

a. $\frac{1}{9}$
c. 3
b. $\frac{1}{3}$
d. 9

____ 47. If a 325 W heater has a current of 6.0 A, what is the resistance of the heating element?

a. 88 Ω
c. 9.0 Ω
b. 54 Ω
d. 4.5 Ω

____ 48.



What happens when the switch is closed in the circuit shown above?

a. The lamp lights because current from the battery flows through the lamp.
b. Current from the battery flows through the resistor.
c. Current from the battery flows through both the lamp and the resistor.
d. The lamp goes out, because the battery terminals connect to each other.

____ 49. If the potential difference across the bulb in a camping lantern is 9.0 V, what is the potential difference across the battery used to power it?

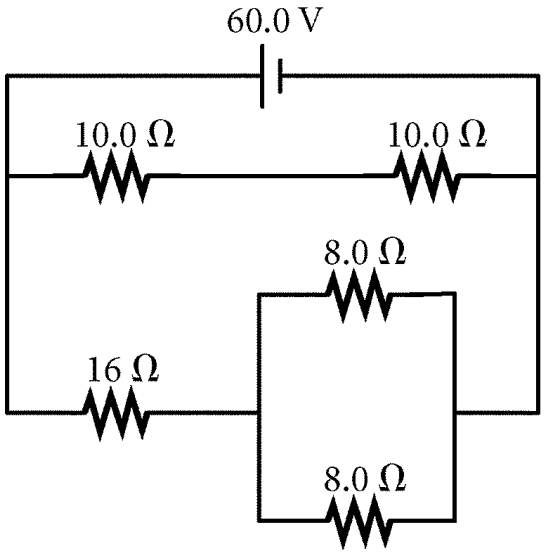
a. 1.0 V
c. 9.0 V
b. 3.0 V
d. 18 V

____ 50. Three resistors with values of 4.0 Ω, 6.0 Ω, and 8.0 Ω, respectively, are connected in series. What is their equivalent resistance?

a. 18 Ω
c. 6.0 Ω
b. 8.0 Ω
d. 1.8 Ω

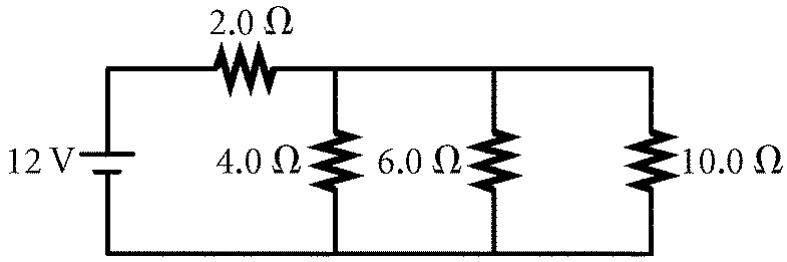
____ 51. Three resistors with values of 4.0 Ω, 6.0 Ω, and 10.0 Ω are connected in parallel. What is their equivalent resistance?

a. 20.0 Ω
c. 6.0 Ω
b. 7.3 Ω
d. 1.9 Ω



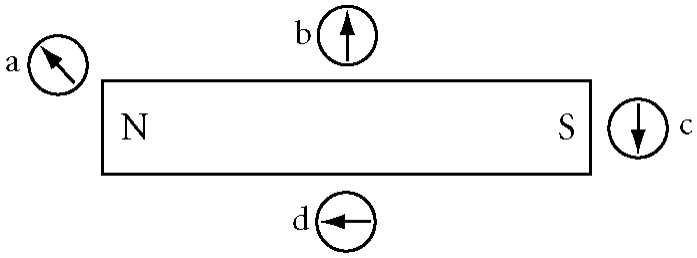
____ 52. What is the equivalent resistance of the resistors in the figure shown above?
a. 7.5 Ω
b. 10 Ω
c. 16 Ω
d. 18 Ω

____ 53. Two resistors with values of 6.0 Ω and 12 Ω are connected in parallel. This combination is connected in series with a 4.0 Ω resistor. What is the equivalent resistance of this combination?
a. 0.50 Ω
b. 2.0 Ω
c. 8.0 Ω
d. 22 Ω



____ 54. Three resistors connected in parallel have individual values of 4.0 Ω, 6.0 Ω, and 10.0 Ω, as shown above. If this combination is connected in series with a 12.0 V battery and a 2.0 Ω resistor, what is the current in the 10.0 Ω resistor?
a. 0.58 A
b. 1.0 A
c. 11 A
d. 16 A

____ 55. Where is the magnitude of the magnetic field around a permanent magnet greatest?
a. The magnitude is greatest close to the poles.
b. The magnitude is greatest far from the poles.
c. The magnitude is equal at all points on the field.
d. The magnitude is greatest halfway between poles.



____ 56. Which compass needle orientation in the figure above might correctly describe the magnet's field at that point?
a. a
b. b
c. c
d. d

____ 57. An electron moves north at a velocity of 4.5×10^{4} m/s and has a magnetic force of 7.2×10^{-18} N exerted on it. If the magnetic field points upward, what is the magnitude of the magnetic field?
a. 1.0 mT
b. 2.0 mT
c. 3.6 mT
d. 4.8 mT

____ 58. An electron that moves with a speed of 3.0×10^{4} m/s perpendicular to a uniform magnetic field of 0.40 T experiences a force of what magnitude? ($q_e = 1.60 \times 10^{-19}$ C)
a. 2.2×10^{24} N
b. 1.9×10^{15} N
c. 4.8×10^{14} N
d. 0 N

____ 59. The direction of the force on a current-carrying wire in an external magnetic field is
a. perpendicular to the current only.
b. perpendicular to the magnetic field only.
c. perpendicular to both the current and the magnetic field.
d. parallel to the current and to the magnetic field.

____ 60. What is the path of an electron moving perpendicular to a uniform magnetic field?
a. straight line
b. circle
c. ellipse
d. parabola

____ 61. What is the path of an electron moving parallel to a uniform magnetic field?
a. straight line
b. circle
c. ellipse
d. parabola

____ 62. A current-carrying wire 0.50 m long is positioned perpendicular to a uniform magnetic field. If the current is 10.0 A and there is a resultant force of 3.0 N on the wire due to the interaction of the current and field, what is the magnetic field strength?
a. 0.60 T
b. 15 T
c. 1.8×10^{3} T
d. 6.7×10^{3} T

____ 63. Consider two long, straight, parallel wires, each carrying a current *I*. If the currents move in opposite directions,
a. the two wires will attract each other.
b. the two wires will repel each other.
c. the two wires will exert a torque on each other.
d. neither wire will exert a force on the other.

____ 64. A mass attached to a spring vibrates back and forth. At the equilibrium position, the
a. acceleration reaches a maximum.
b. velocity reaches a maximum.
c. net force reaches a maximum.
d. velocity reaches zero.

____ 65. A simple pendulum swings in simple harmonic motion. At maximum displacement,
a. the acceleration reaches a maximum.
b. the velocity reaches a maximum.
c. the acceleration reaches zero.
d. the restoring force reaches zero.

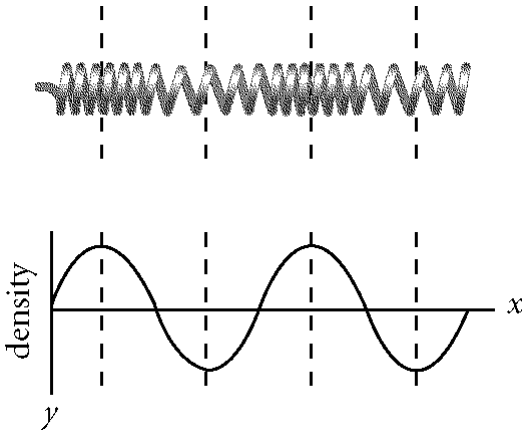
____ 66. For a system in simple harmonic motion, which of the following is the number of cycles or vibrations per unit of time?
a. amplitude
b. period
c. frequency
d. revolution

____ 67. How are frequency and period related in simple harmonic motion?
a. They are directly related.
b. They are inversely related.
c. Their sum is constant.
d. Both measure the number of cycles per unit of time.

____ 68. By what factor should the length of a simple pendulum be changed in order to triple the period of vibration?
a. 3
b. 6
c. 9
d. 27

____ 69. A wave travels through a medium. As the wave passes, the particles of the medium vibrate in a direction perpendicular to the direction of the wave's motion. The wave is
a. longitudinal.
b. a pulse.
c. electromagnetic.
d. transverse.

____ 70. One end of a taut rope is fixed to a post. What type of wave is produced if the free end is quickly raised and lowered one time?
a. pulse wave
b. periodic wave
c. sine wave
d. longitudinal wave



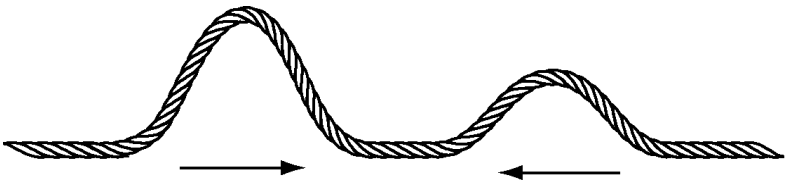
____ 71. Each compression in the waveform of the longitudinal wave shown above corresponds to what feature of the transverse wave below it?
a. wavelength
b. crests
c. troughs
d. amplitude

____ 72. Each stretched region in the waveform of the longitudinal wave shown above corresponds to what feature of the transverse wave below it?
a. wavelength
b. crests
c. troughs
d. amplitude

____ 73. When two mechanical waves coincide, the amplitude of the resultant wave is always ____ the amplitudes of each wave alone.
a. greater than
b. less than
c. the sum of
d. the same as

____ 74. Two mechanical waves that have positive displacements from the equilibrium position meet and coincide. What kind of interference occurs?
a. constructive
b. destructive
c. complete destructive
d. none

____ 75. Two mechanical waves meet and coincide. One wave has a positive displacement from the equilibrium position, and the other wave has a negative displacement. What kind of interference occurs?
a. constructive
b. destructive
c. complete constructive
d. none



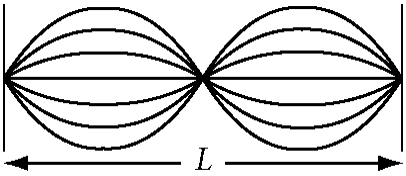
____ 76. Which of the following types of interference will occur when the pulses in the figure above meet?
a. no interference
b. constructive interference
c. destructive interference
d. total interference

____ 77. Waves arriving at a fixed boundary are
a. neither reflected nor inverted.
b. reflected but not inverted.
c. reflected and inverted.
d. inverted but not reflected.

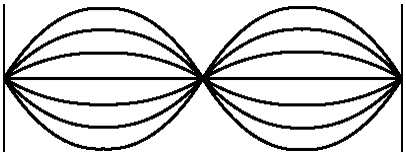
____ 78. Waves arriving at a free boundary are
a. neither reflected nor inverted.
b. reflected but not inverted.
c. reflected and inverted.
d. inverted but not reflected.

____ 79. Which of the following wavelengths 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

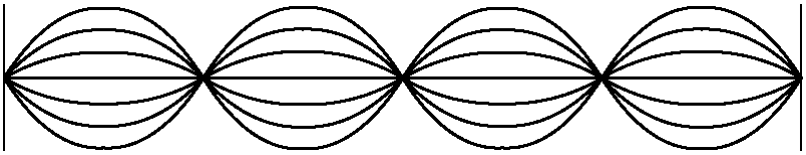
____ 80. Which of the following wavelengths would *not* produce standing waves on a rope whose length is 1 m?
a. 2/3 m
b. 1 m
c. 2 m
d. 2 1/4 m



____ 81. The standing wave shown in the diagram above would be produced on a string of length *L* by a wave having wavelength
a. 1/2 *L*.
b. *L*.
c. 2 *L*.
d. 4 *L*.



____ 82. 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



____ 83. How many nodes and antinodes are shown in the standing wave above?
a. four nodes and four antinodes
b. four nodes and three antinodes
c. four nodes and five antinodes
d. five nodes and four antinodes

____ 84. Sound waves
a. are a part of the electromagnetic spectrum.
b. do not require a medium for transmission.
c. are longitudinal waves.
d. are transverse waves.

____ 85. The trough of the sine curve used to represent a sound wave corresponds to
a. a compression.
b. the wavelength.
c. the amplitude.
d. a rarefaction.

____ 86. Which of the following is the region of a sound wave in which the density and pressure are greater than normal?
a. rarefaction
b. compression
c. amplitude
d. wavelength

____ 87. The highness or lowness of a sound is perceived as
a. compression.
b. wavelength.
c. ultrasound.
d. pitch.

____ 88. Pitch depends on the ____ of a sound wave.
a. frequency
b. amplitude
c. power
d. speed

____ 89. In general, sound travels faster through
a. solids than through gases.
b. gases than through solids.
c. gases than through liquids.
d. empty space than through matter.

____ 90. A train moves down the track toward an observer. The sound from the train, as heard by the observer, is ____ the sound heard by a passenger on the train.
a. the same as
b. a different timbre than
c. higher in pitch than
d. lower in pitch than

____ 91. The Doppler effect occurs with
a. only sound waves.
b. only transverse waves.
c. only water waves.
d. all waves.

____ 92. At a distance of 3 m, the intensity of a sound will be ____ the intensity it was at a distance of 1 m.
a. one-ninth
b. one-third
c. 3 times
d. 9 times

____ 93. If a guitar string has a fundamental frequency of 500 Hz, what is the frequency of its second harmonic?
a. 250 Hz
b. 750 Hz
c. 1000 Hz
d. 2000 Hz

____ 94. How many beats per second are heard when two vibrating tuning forks having frequencies of 342 Hz and 345 Hz are held side by side?
a. 687 Hz
b. 343.5 Hz
c. 5 Hz
d. 3 Hz

____ 95. Which portion of the electromagnetic spectrum is used in a television?
a. infrared waves
b. X rays
c. radio waves
d. gamma waves

____ 96. Which portion of the electromagnetic spectrum is used in a microscope?
a. infrared waves
b. gamma rays
c. visible light
d. ultraviolet light

____ 97. Which portion of the electromagnetic spectrum is used to identify fluorescent minerals?
a. ultraviolet light
b. X rays
c. infrared waves
d. gamma rays

____ 98. What is the wavelength of microwaves of 3.0×10^{9} Hz frequency?
a. 0.050 m
b. 0.060 m
c. 0.10 m
d. 0.20 m

____ 99. What is the frequency of an electromagnetic wave with a wavelength of $1.0 \acute{} 10^{5}$ m?
a. 3.3×10^{-4} Hz
b. 3.0×10^{3} Hz
c. 1.0×10^{13} Hz
d. 3.0×10^{13} Hz

____ 100. In a vacuum, electromagnetic radiation of short wavelengths
a. travels as fast as radiation of long wavelengths.
b. travels slower than radiation of long wavelengths.
c. travels faster than radiation of long wavelengths.
d. can travel both faster and slower than radiation of long wavelengths.

____ 101. When red light is compared with violet light,
a. both have the same frequency.
b. both have the same wavelength.
c. both travel at the same speed.
d. red light travels faster than violet light.

____ 102. Snow reflects almost all of the light incident upon it. However, a single beam of light is not reflected in the form of parallel rays. This is an example of ____ reflection off a ____ surface.
a. regular, rough
b. regular, specular
c. diffuse, specular
d. diffuse, rough

____ 103. 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.

____ 104. If a light ray strikes a flat mirror at an angle of 14° from the normal, the reflected ray will be
a. 14° from the mirror's surface.
b. 76° from the normal.
c. 90° from the mirror's surface.
d. 14° from the normal.

____ 105. The image of an object in a flat mirror is always
a. larger than the object.
b. smaller than the object.
c. independent of the size of the object.
d. the same size as the object.

____ 106. 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

____ 107. Which of the following best describes the image produced by a flat mirror?
a. virtual, inverted, and magnification greater than one
b. real, inverted, and magnification less than one
c. virtual, upright, and magnification equal to one
d. real, upright, and magnification equal to one

____ 108. For a spherical mirror, the focal length is equal to ____ the radius of curvature of the mirror.
a. one-fourth
b. one-third
c. one-half
d. the square of

____ 109. 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 cm
b. 15 cm
c. 7.5 cm
d. 5.0 cm

____ 110. 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 cm
b. 12 cm
c. 6.0 cm
d. 3.0 cm

____ 111. A mirror has an object located on its principal axis 40.0 cm from the mirror's surface. A virtual image is formed 15.0 cm behind the mirror. What is the mirror's focal length?
a. –24.0 cm
b. –10.9 cm
c. 2.38 cm
d. 13 cm

____ 112. When red light and green light shine on the same place on a piece of white paper, the spot appears to be
a. yellow.
b. brown.
c. white.
d. black.

____ 113. Which of the following is *not* an additive primary color?
a. yellow
b. blue
c. red
d. green

____ 114. Which of the following is *not* a primary subtractive color?
a. yellow
b. cyan
c. magenta
d. blue

____ 115. Part of a pencil that is placed in a glass of water appears bent in relation to the part of the pencil that extends out of the water. What is this phenomenon called?
a. interference
b. refraction
c. diffraction
d. reflection

____ 116. Refraction is the bending of a wave disturbance as it passes at an angle from one ____ into another.
a. glass
b. medium
c. area
d. boundary

____ 117. The ____ of light can change when light is refracted because the medium changes.
a. frequency
b. medium
c. wavelength
d. transparency

____ 118. When light passes at an angle to the normal from one material into another material in which its speed is higher,
a. it is bent toward the normal to the surface.
b. it always lies along the normal to the surface.
c. it is unaffected.
d. it is bent away from the normal to the surface.

____ 119. When a light ray moves from air into glass, which has a higher index of refraction, its path is
a. bent toward the normal.
b. bent away from the normal.
c. parallel to the normal.
d. not bent.

____ 120. A ray of light in air is incident on an air-to-glass boundary at an angle of exactly 30.0° with the normal. If the index of refraction of the glass is 1.65, what is the angle of the refracted ray within the glass with respect to the normal?
a. 58.3°
b. 37.3°
c. 34.4°
d. 18.0°

____ 121. The focal length for a converging lens is
a. always positive.
b. always negative.
c. dependent on the location of the object.
d. dependent on the location of the image.

____ 122. A virtual image has a ____ image distance (q) and is located in ____ of the lens.
a. positive, front
b. positive, back
c. negative, front
d. negative, back

____ 123. The focal length for a diverging lens is
a. always positive.
b. always negative.
c. dependent on the location of the object.
d. dependent on the location of the image.

____ 124. An object is placed 20.0 cm from a thin converging lens along the axis of the lens. If a real image forms behind the lens at a distance of 8.00 cm from the lens, what is the focal length of the lens?
a. 5.71 cm
b. 12.0 cm
c. –13.3 cm
d. 13.3 cm

____ 125. An object is placed 14.0 cm from a diverging lens. If a virtual image appears 10.0 cm from the lens on the same side as the object, what is the focal length of the lens?
a. –50 cm
b. –34 cm
c. –5.8 cm
d. –1.6 cm

____ 126. An object that is 18 cm from a converging lens forms a real image 22.5 cm from the lens. What is the magnification of the image?
a. –1.25
b. –0.80
c. 0.80
d. 1.25

____ 127. Which is *not* correct when describing the formation of rainbows?
a. A rainbow is really spherical in nature.
b. Sunlight is spread into a spectrum when it enters a spherical raindrop.
c. Sunlight is internally reflected on the back side of a raindrop.
d. All wavelengths refract at the same angle.

Problem

128. What is the electric force between an electron and a proton that are separated by a distance of 1.0×10^{-10} m? Is the force attractive or repulsive? ($e = 1.60 \times 10^{-19}$ C, $k_C = 8.99 \times 10^9$ N•m^2/C^2)

129. Two equal charges are separated by 3.7×10^{-10} m. The force between the charges has a magnitude of 2.37×10^{-3} N. What is the magnitude of q on the charges? ($k_C = 8.99 \times 10^9$ N•m^2/C^2)

130. If a force of 50 N stretches a spring 0.10 m, what is the spring constant?

131. 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?

132. What is the period of a 4.12 m long pendulum with a bob of mass 75.0 kg?

133. A periodic wave has a wavelength of 0.50 m and a speed of 20 m/s. What is the wave frequency?

134. What length of guitar string would vibrate at a fundamental frequency of 825 Hz if the string is stretched so that the velocity of waves on the string is 577 m/s?

135. A resonating glass tube closed at one end is 4.0 cm wide and 47.0 cm long. What are the frequencies of the first two harmonics for the resonating tube? The speed of sound in air at this temperature is 346 m/s.

Cp physics - Spring Final Review (second semester topics)
Answer Section

MULTIPLE CHOICE

1. B
2. A
3. B
4. C
5. D
6. D
7. A
8. A
9. B
10. C
11. C
12. B
13. A
14. B
15. B
16. C
17. B
18. A
19. D
20. A
21. D
22. B
23. D
24. C
25. A
26. D
27. B
28. A
29. B
30. C
31. B
32. D
33. A
34. D
35. D
36. B
37. A
38. B

39. C
40. B
41. A
42. C
43. B
44. D
45. A
46. D
47. C
48. D
49. C
50. A
51. D
52. B
53. C
54. A
55. A
56. A
57. A
58. B
59. C
60. B
61. A
62. A
63. B
64. B
65. A
66. C
67. B
68. C
69. D
70. A
71. B
72. C
73. C
74. A
75. B
76. B
77. C
78. B
79. A
80. D
81. B

82. D
83. D
84. C
85. D
86. B
87. D
88. A
89. A
90. C
91. D
92. A
93. C
94. D
95. C
96. C
97. A
98. C
99. B
100. A
101. C
102. D
103. A
104. D
105. D
106. C
107. C
108. C
109. B
110. A
111. A
112. A
113. A
114. D
115. B
116. B
117. C
118. D
119. A
120. D
121. A
122. C
123. B
124. A

125. B
126. A
127. D

PROBLEM

128. 2.3×10^{-8} N; attractive

Given

$q_e = -e = -1.60 \times 10^{-19}$ C

$q_p = +e = +1.60 \times 10^{-19}$ C

$r = 1.0 \times 10^{-10}$ m

$k_C = 8.99 \times 10^{9}$ N•m^2/C^2

Solution

$$F_{electric} = k_C \frac{q_e q_p}{r^2} = \left(8.99 \times 10^{9}\ \text{Nm}^2/\text{C}^2\right)\left(\frac{\left(-1.60 \times 10^{-19}\ \text{C}\right)\left(+1.60 \times 10^{-19}\ \text{C}\right)}{\left(1.0 \times 10^{-10}\ \text{m}\right)^2}\right)$$

$F_{electric} = -2.3 \times 10^{-8}$ N

129. 1.9×10^{-16} C

Given

$q_1 = q_2$

$F_{electric} = 2.37 \times 10^{-3}$ N

$r = 3.7 \times 10^{-10}$ m

$k_C = 8.99 \times 10^{9}$ N•m^2/C^2

Solution

$$F_{electric} = k_C \frac{q_1 q_2}{r^2} = \frac{k_C q^2}{r^2}$$

$$q = \sqrt{\frac{F_{electric} r^2}{k_C}} = \sqrt{\frac{(2.37 \times 10^{-3}\ \text{N})(3.7 \times 10^{-10}\ \text{m})^2}{8.99 \times 10^{9}\ \text{Nm}^2\text{C}^2}}$$

$$q = \sqrt{\frac{(2.37 \times 10^{-3}\ \text{N})(1.4 \times 10^{-19}\ \text{m}^2)}{8.99 \times 10^{9}\ \text{Nm}^2/\text{C}^2}}$$

$q = 1.9 \times 10^{-16}$ C

130. 500 N/M

Given
$F_{elastic} = 50$ N
$x = -0.10$ m

Solution
$F_{elastic} = -kx$

$$k = \frac{-F_{elastic}}{x} = \frac{-50\text{ N}}{-0.10\text{ m}}$$

$k = 500$ N/m

131. –0.5 m

Given
$k = 120$ N/m
$F_{elastic} = 60$ N

Solution
$F_{elastic} = -kx$

$$x = -\frac{F_{elastic}}{k} = -\frac{60\text{ N}}{120\text{ N/m}}$$

$x = -0.5$ m

132. 4.07 s

Given
$L = 4.12$ m
$m = 75.0$ kg (This mass is not relevant to the problem.)

Solution

$$T = 2\pi\sqrt{\frac{L}{a_g}} = 2\pi\sqrt{\frac{4.12\text{ m}}{9.81\text{ m/s}^2}} = 4.07\text{ s}$$

133. 40 Hz

Given
$v = 20$ m/s
$\lambda = 0.50$ m

Solution
$v = f\lambda$

$$f = \frac{v}{\lambda} = \frac{20\text{ m/s}}{0.50\text{ m}} = 40\text{ Hz}$$

134. 0.350 m

Given
$v = 577$ m/s
$f = 825$ Hz

Solution

$$f_1 = \frac{v}{2L}$$

$$L = \frac{v}{2f_1} = \frac{577 \text{ m/s}}{2(825 \text{ Hz})} = 0.350 \text{ m}$$

135. 184 Hz, 552 Hz

Given
$v = 346$ m/s
$L = 47$ cm $= 0.47$ m
The diameter of the tube is irrelevant to the problem.

Solution
For a resonating tube closed at one end,

$$f_n = n\frac{v}{4L}$$

At the fundamental frequency (first harmonic), $n = 1$, so

$$f_1 = \frac{v}{4L} = \frac{346 \text{ m/s}}{4(0.47 \text{ m})} = 184 \text{ Hz}$$

The next harmonic in a closed pipe is the third, where $n = 3$.

$$f_3 = 3\frac{v}{4L} = 3\left(\frac{346 \text{ m/s}}{4(0.47 \text{ m})}\right) = 552 \text{ Hz}$$