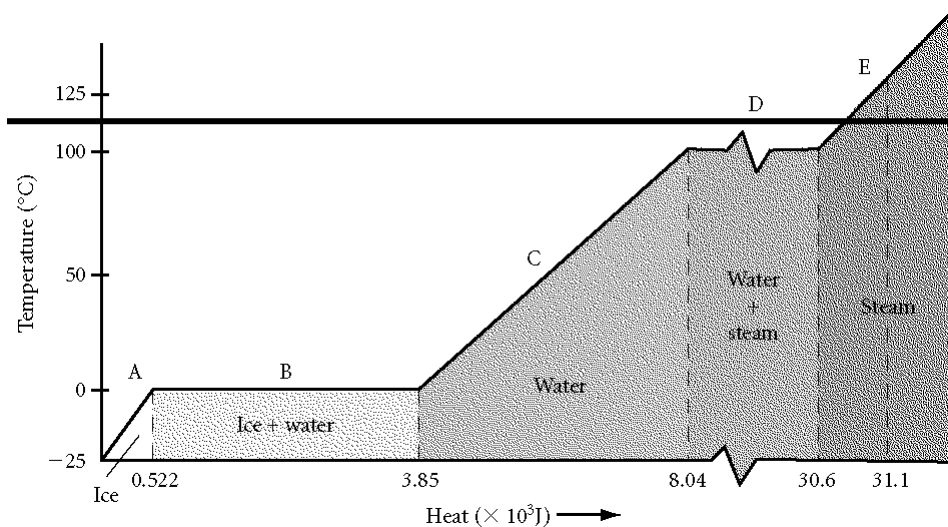


Sample 2nd Semester Exam

Multiple Choice

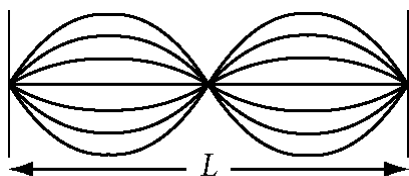
Identify the letter of the choice that best completes the statement or answers the question.

- What are the energies associated with atomic motion called?
a. kinetic energy b. potential energy c. bond energy d. internal energy
- As the temperature of a substance increases, its volume tends to increase due to
a. thermal equilibrium. c. thermal expansion.
b. thermal energy. d. thermal contraction.
- What temperature has the same numerical value on both the Fahrenheit and the Celsius scales?
a. -40.0° b. 0° c. 40.0° d. -72.0°
- 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
- In an elastic collision between two ball bearings, kinetic energy is conserved. If there is no change in potential energy, which of the following is true?
a. $\Delta U > 0$ c. $\Delta U < 0$
b. $\Delta U = 0$ d. ΔU cannot be determined for this event.
- 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 \cdot° 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

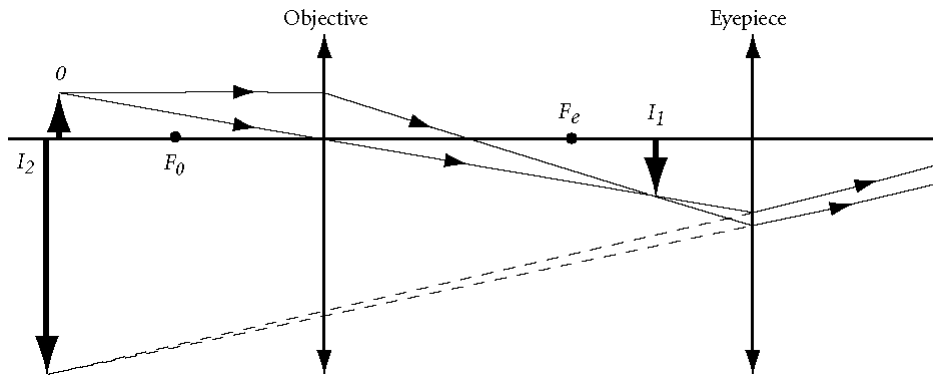


- At what point on the figure above is the amount of energy transferred as heat approximately 4.19×10^3 J?
a. A b. B c. C d. D
- Which of the following is a set of particles or interacting components to which energy is added or from which energy is removed?
a. an ideal gas b. an engine c. a system d. an environment
- 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
- What thermodynamic process for an ideal gas system has an unchanging internal energy and a heat intake that corresponds to the value of the work done by the system?
a. isovolumetric b. isobaric c. adiabatic d. isothermal

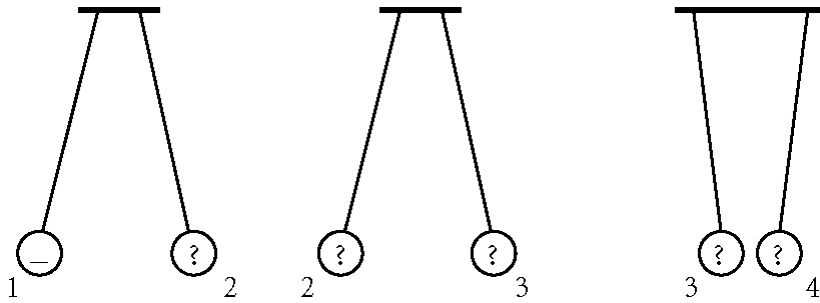
11. How is conservation of internal energy expressed for a system during an adiabatic process?
- $Q = W = 0$, so $\Delta U = 0$ and $U_i = U_f$
 - $Q = 0$, so $\Delta U = -W$
 - $\Delta T = 0$, so $\Delta U = 0$; therefore, $\Delta U = Q - W = 0$, or $Q = W$
 - $\Delta V = 0$, so $P\Delta V = 0$ and $W = 0$; therefore, $\Delta U = Q$
12. An electrical power plant manages to transfer 88 percent of the heat produced in the burning of fossil fuel to convert water to steam. Of the heat carried by the steam, 40 percent is converted to the mechanical energy of the spinning turbine. Which best describes the overall efficiency of the heat-to-work conversion in the plant?
- greater than 88 percent
 - 88 percent
 - 40 percent
 - less than 40 percent
13. When a drop of ink mixes with water, what happens to the entropy of the system?
- The system's entropy increases, and the total entropy of the universe increases.
 - The system's entropy decreases, and the total entropy of the universe increases.
 - The system's entropy increases, and the total entropy of the universe decreases.
 - The system's entropy decreases, and the total entropy of the universe decreases.
14. Which statement applies when all of the entropy changes in a process are taken into account?
- The increases in entropy are always less than the decreases.
 - The increases in entropy are always equal to the decreases.
 - The increases in entropy are always greater than the decreases.
 - The increases in entropy can be greater or less than the decreases.
15. A mass attached to a spring vibrates back and forth. At the equilibrium position, the
- acceleration reaches a maximum.
 - velocity reaches a maximum.
 - net force reaches a maximum.
 - velocity reaches zero.
16. When two mechanical waves coincide, the amplitude of the resultant wave is always _____ the amplitudes of each wave alone.
- greater than
 - less than
 - the sum of
 - the same as
17. Consider two identical wave pulses on a rope having a fixed end. Suppose the first pulse reaches the end of the rope, is reflected back, and then meets the second pulse. When the two pulses overlap exactly, what will be the amplitude of the resultant pulse?
- zero
 - same as the original pulses
 - double the amplitude of the original pulses
 - half the amplitude of the original pulses
18. Waves arriving at a fixed boundary are
- neither reflected nor inverted.
 - reflected but not inverted.
 - reflected and inverted.
 - inverted but not reflected.
19. Standing waves are produced by periodic waves of
- any amplitude and wavelength traveling in the same direction.
 - the same amplitude and wavelength traveling in the same direction.
 - any amplitude and wavelength traveling in opposite directions.
 - the same frequency, amplitude, and wavelength traveling in opposite directions.
20. Which of the following wavelengths would *not* produce standing waves on a rope whose length is 1 m?
- $2/3$ m
 - 1 m
 - 2 m
 - $2\frac{1}{4}$ m
21. The highness or lowness of a sound is perceived as
- compression.
 - wavelength.
 - ultrasound.
 - pitch.
22. At a large distance from a sound source, spherical wave fronts are viewed as
- wavelengths.
 - troughs.
 - rays.
 - plane waves.
23. The Doppler effect occurs with
- only sound waves.
 - only transverse waves.
 - only water waves.
 - all waves.
24. If the intensity of a sound is increased by a factor of 100, the new decibel level will increase
- by two units.
 - to twice the old one.
 - by a factor of 10.
 - by 20 units.



25. The standing wave shown in the diagram above would be produced on a string of length L by a wave having wavelength
- $1/2 L$.
 - L .
 - $2L$.
 - $4L$.
- 25.
26. When the frequency of a force applied to a system matches the natural frequency of vibration of the system, ____ occurs.
- damped vibration
 - random vibration
 - timbre
 - resonance
27. The wavelength of the fundamental frequency of a vibrating string of length L is
- $1/2 L$.
 - L .
 - $2L$.
 - $4L$.
28. Four beats per second are heard when two notes are sounded. The frequency of one note is 420 Hz. Which of the following is a possible frequency of the other note?
- 418 Hz
 - 105 Hz
 - 416 Hz
 - 1680 Hz
29. Which portion of the electromagnetic spectrum is used in a television?
- infrared waves
 - X rays
 - radio waves
 - gamma waves
30. The mirror equation and ray diagrams are valid concepts only for what type of rays?
- parallel rays
 - perpendicular rays
 - intersecting rays
 - paraxial rays
31. Object distance, image distance, and radius of curvature are ____ for curved mirrors.
- interdependent
 - independent
 - directly related
 - unrelated
32. 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?
- 20 cm
 - 15 cm
 - 7.5 cm
 - 5.0 cm
33. 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?
- 30 cm**
 - 12 cm
 - 6.0 cm
 - 3.0 cm
34. When red light and green light shine on the same place on a piece of white paper, the spot appears to be
- yellow.
 - brown.
 - white.
 - black.
35. As the angle between the electric-field waves and the transmission axis increases,
- the component of light that passes through the polarizer decreases and the brightness of the light decreases.
 - the component of light that passes through the polarizer decreases and the brightness of the light increases.
 - the component of light that passes through the polarizer increases and the brightness of the light decreases.
 - the component of light that passes through the polarizer increases and the brightness of the light increases.
36. 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?
- interference
 - refraction
 - diffraction
 - reflection
37. All of the following images can be formed by a converging lens *except* which one?
- virtual, upright, and magnified
 - real and point
 - real, inverted, and magnified
 - real, upright, and magnified
38. A virtual image has a ____ image distance (q) and is located in ____ of the lens.
- positive, front
 - positive, back
 - negative, front
 - negative, back
39. 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?
- -50 cm
 - -34 cm
 - -5.8 cm
 - -1.6 cm



40. In the diagram of a compound microscope shown above, where would you place the slide?
- at O
 - at I_2
 - at F_0
 - at I_1
41. Which of the following describes what will happen to a light ray incident on a glass-to-air boundary at greater than the critical angle?
- total internal reflection
 - total external transmission
 - partial reflection, partial transmission
 - partial reflection, total transmission
42. If atmospheric refraction did not occur, how would the apparent time of sunrise and sunset be changed?
- Both would be later.
 - Both would be earlier.
 - Sunrise would be later, and sunset would be earlier.
 - Sunrise would be earlier, and sunset would be later.
43. Charge is most easily transferred in
- nonconductors.
 - conductors.
 - semiconductors.
 - insulators.
44. Which sentence best describes electrical conductors?
- Electrical conductors have low mass density.
 - Electrical conductors have high tensile strength.
 - Electrical conductors have electric charges that move freely.
 - Electrical conductors are poor heat conductors.
45. A surface charge can be produced on insulators by
- grounding.
 - induction.
 - polarization.
 - contact.
46. Conductors can be charged by _____, while insulators cannot.
- grounding
 - induction
 - polarization
 - contact
47. A lightbulb has a resistance of $240\ \Omega$ when operating at $120\ \text{V}$. What is the current in the lightbulb?
- $2.0\ \text{A}$
 - $1.0\ \text{A}$
 - $0.50\ \text{A}$
 - $0.20\ \text{A}$
48. If the charge is tripled for two identical charges maintained at a constant separation, the electric force between them will be changed by what factor?
- $\frac{1}{9}$
 - $\frac{2}{3}$
 - 9
 - 18



48. 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?
- Ball 4 may have either a positive or negative charge.
 - Ball 4 has a negative charge.
 - Ball 4 has a positive charge.
 - It is not possible to determine the charge on ball 4.
50. Which is the *most* correct statement regarding the drawing of electric field lines?
- Electric field lines always connect from one charge to another.
 - Electric field lines always form closed loops.
 - Electric field lines can start on a charge of either polarity.
 - Electric field lines never cross each other.
51. Increasing the potential difference between the plates of a capacitor will produce what effect on the capacitor?
- It will increase the charge on each plate.
 - It will decrease the charge on each plate.
 - It will increase the capacitance.
 - It will decrease the capacitance.
52. A $1.5 \mu\text{F}$ capacitor is connected to a 9.0 V battery. Use the expression $PE = \frac{1}{2}C(\Delta V)^2$ to determine how much energy is stored in the capacitor.
- $1.1 \times 10^{-11} \text{ J}$
 - $6.1 \times 10^{-5} \text{ J}$
 - $6.1 \times 10^{-2} \text{ J}$
 - 60.8 J
53. The amount of charge that moves through the filament of a lightbulb in 2.00 s is 2.67 C . What is the current in the lightbulb?
- 5.34 A
 - 1.33 A
 - 0.835 A
 - 0.417 A
54. When compared in a given time interval with other lightbulbs connected to a 120 V circuit, a 60 W lightbulb
- converts the same electrical energy to heat and light as a 40 W lightbulb.
 - converts more electrical energy to heat and light than a 100 W lightbulb.
 - converts less electrical energy to heat and light than a 40 W lightbulb.
 - converts less electrical energy to heat and light than a 100 W lightbulb.
55. If a 75 W lightbulb operates at a voltage of 120 V , what is the current in the bulb?
- 0.62 A
 - 1.6 A
 - $1.95 \times 10^2 \text{ A}$
 - $9.0 \times 10^3 \text{ A}$
56. Two resistors with values of 6.0Ω and 12Ω are connected in parallel. This combination is connected in series with a 4.0Ω resistor. What is the equivalent resistance of this combination?
- 0.50Ω
 - 2.0Ω
 - 8.0Ω
 - 22Ω
57. Three resistors with values of 4.0Ω , 6.0Ω , and 8.0Ω , respectively, are connected in series. What is their equivalent resistance?
- 18Ω
 - 8.0Ω
 - 6.0Ω
 - 1.8Ω
58. A steam turbine at an electric power plant delivers 4500 kW of power to an electrical generator that converts 95 percent of this mechanical energy into electrical energy. What is the current delivered by the generator if it delivers energy at 3600 V ?
- $0.66 \times 10^3 \text{ A}$
 - $1.0 \times 10^3 \text{ A}$
 - $1.2 \times 10^3 \text{ A}$
 - $5.9 \times 10^3 \text{ A}$

59. Which of the following is the best description of a schematic diagram?
- uses pictures to represent the parts of a circuit
 - determines the location of the parts of a circuit
 - shows the parts of a circuit and how the parts connect to each other
 - shows some of the parts that make up a circuit
60. Three resistors connected in series carry currents labeled I_1 , I_2 , and I_3 , respectively. Which of the following expresses the total current, I_t , in the system made up of the three resistors in series?
- $I_t = I_1 + I_2 + I_3$
 - $I_t = \left(\frac{1}{I_1} + \frac{1}{I_2} + \frac{1}{I_3} \right)^{-1}$
 - $I_t = I_1 = I_2 = I_3$
 - $I_t = \left(\frac{1}{I_1} + \frac{1}{I_2} + \frac{1}{I_3} \right)^{-1}$
61. Three resistors connected in parallel have potential differences across them labeled ΔV_1 , ΔV_2 , and ΔV_3 . Which of the following expresses the potential difference across all three resistors?
- $\Delta V_t = \Delta V_1 + \Delta V_2 + \Delta V_3$
 - $\Delta V_t = \left(\frac{1}{\Delta V_1} + \frac{1}{\Delta V_2} + \frac{1}{\Delta V_3} \right)^{-1}$
 - $\Delta V_t = \Delta V_1 = \Delta V_2 = \Delta V_3$
 - $\Delta V_t = \left(\frac{1}{\Delta V_1} + \frac{1}{\Delta V_2} + \frac{1}{\Delta V_3} \right)^{-1}$
62. One useful way to model magnetic field strength is to define a quantity called magnetic flux Φ_M . Which of the following definitions for magnetic flux, Φ_M , is correct?
- the number of field lines that cross a certain area
 - $AB \cos \theta$
 - (surface area) \times (magnetic field component normal to the plane of surface)
 - all of the above
63. A current in a long, straight wire produces a magnetic field. These magnetic field lines
- radiate out from the wire to infinity.
 - come in from infinity to the wire.
 - form circles that pass through the wire.
 - form circles that go around the wire.
64. According to the right-hand rule, if a current-carrying wire is grasped in the right hand with the thumb in the direction of the current, the four fingers will curl in the direction of
- the magnetic force, $\mathbf{F}_{\text{magnetic}}$.
 - the magnetic field, \mathbf{B} .
 - the current's velocity, \mathbf{v} .
 - the current's path, \mathbf{P} .
65. Under which of the following conditions is the net magnetic force on a charged particle equal to zero?
- when the particle is stationary
 - when the particle is moving parallel to the magnetic field
 - when the particle is not charged
 - all of the above
66. The direction of the force on a current-carrying wire in an external magnetic field is
- perpendicular to the current only.
 - perpendicular to the magnetic field only.
 - perpendicular to both the current and the magnetic field.
 - parallel to the current and to the magnetic field.
67. What is the path of an electron moving parallel to a uniform magnetic field?
- straight line
 - circle
 - ellipse
 - parabola
68. Consider two long, straight, parallel wires, each carrying a current I . If the currents move in the same direction,
- the two wires will attract each other.
 - the two wires will repel each other.
 - the two wires will exert a torque on each other.
 - neither wire will exert a force on the other.

69. Electromagnetic waves are ____ electric and magnetic fields.
a. transverse b. constant c. oscillating d. parallel
70. How does an electromagnetic wave propagate itself?
a. A changing magnetic field induces an electric field perpendicular to the magnetic field.
b. A changing electric field induces a magnetic field perpendicular to the electric field.
c. Changing electric and magnetic fields produce a transverse wave that is perpendicular to both of the oscillating fields.
d. all of the above
71. Where is energy stored in electromagnetic waves?
a. in the wave's moving atoms
b. in the oscillating electric and magnetic fields
c. in the electromagnetic force
d. in the wave's directional vector
72. Which of the following statements about electromagnetic radiation is true?
a. It transfers energy to objects in the path of the electromagnetic waves.
b. It can be converted to other energy forms.
c. It transports the energy of electromagnetic waves.
d. all of the above
73. What do radio waves, microwaves, X rays, and gamma rays all have in common?
a. They are produced in the same way.
b. They are electromagnetic waves.
c. They are detected in the same way.
d. They store the same amount of energy.