MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Convection can occur 1) ________
A) only in gases.
B) only in liquids.
C) only in liquids and gases.
D) only in solids.
E) in solids, liquids, and gases.

2) How much heat is required to raise the temperature of a 225-g lead ball from 15.0°C to 25.0°C? The specific heat of lead is 128 J/(kg·K). 2) ________
A) 725 J B) 576 J C) 217 J D) 288 J E) 145 J

3) The internal energy of an ideal gas depends on 3) ________
A) its volume.
B) its pressure.
C) its temperature and pressure.
D) its temperature.
E) its temperature, pressure, and volume.

4) A 44-g block of ice at -15°C is dropped into a calorimeter (of negligible heat capacity) containing 100 g of water at 5°C. When equilibrium is reached, how much of the ice will have melted? The specific heat of ice is 2090 J/(kg K) and the latent heat of fusion of water is $33.5 \times 10^4$ J/kg. 4) ________
A) 4.4 g B) 2.1 g C) 5.2 g D) 21 g E) 52 g

5) A monatomic ideal gas is compressed adiabatically to one-third of its initial volume. The resulting pressure will be 5) ________
A) less than three times as large as the initial value.
B) more than three times as large as the initial value.
C) equal to the initial value.
D) three times as large as the initial value.
E) impossible to predict on the basis of this data.

6) A Carnot air conditioner operates between an indoor temperature of 20°C and an outdoor temperature of 39°C. How much energy does it need to remove 2000 J of heat from the interior of the house? 6) ________
A) 105 J B) 340 J C) 130 J D) 520 J E) 780 J

7) When the distance between the two charges is doubled, the force between them is 7) ________
A) reduced by a factor of 3.
B) reduced by a factor of $\sqrt{2}$.
C) reduced by a factor of 4.
D) quadrupled.
E) doubled.

8) What are the magnitude and direction of the electric field at a distance of 1.50 m from a 50.0-nC charge? 8) ______

A) 20 N/C toward from the charge
B) 200 N/C toward from the charge
C) 200 N/C away from the charge
D) 20 N/C away from the charge
E) 10 N/C away from the charge

9) An equipotential surface must be 9) ______

A) randomly oriented with respect to the electric field.
B) perpendicular to the electric field at any point.
C) parallel to the electric field at any point.
D) equal to the electric field at any point.

10) Three charges are placed as follows along the $x$- and $y$-axes of an $xy$-coordinate system: $q_1 = 2.00$ μC at $x_1 = 0$ m, $q_2 = 4.00$ μC at $x_2 = 3.00$ m, and $q_3 = 6.00$ μC at $y = 4.00$ m. What is the electric potential energy of this system of charges? 10) ______

A) -90.0 mJ B) -94.2 mJ C) 94.2 mJ D) 0 J E) 90.0 mJ

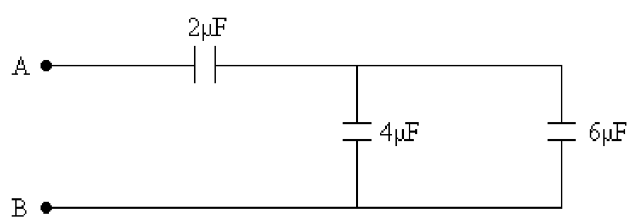
11) A parallel plate capacitor has a potential difference between the plates of 80 V. If the charge on one of the plates of the capacitor is +8.0 μC, what is the electrical energy stored by this capacitor? 11) ______

A) $5.0 \times 10^{-8}$ J
B) $640 \times 10^{-6}$ J
C) $320 \times 10^{-6}$ J
D) $3.0 \times 10^{-8}$ J
E) $6.0 \times 10^{-8}$ J

12) Kirchhoff's junction rule is a statement of 12) ______

A) the law of conservation of charge.
B) the law of conservation of momentum.
C) the law of conservation of angular momentum.
D) the law of conservation of energy.
E) Newton's second law.

Figure 21-17




13) Three capacitors are connected as shown in Figure 21-17. What is the equivalent capacitance between points A and B? 13) ______

A) 4.0 μC B) 12 μF C) 1.7 μF D) 8.0 μF E) 7.1 μF

14) An electron moving in the positive *y* direction, at right angles to a magnetic field, experiences a magnetic force in the negative *x* direction. What is the direction of the magnetic field? 14) ______

A) It is in the positive *y* direction.
B) It is in the negative *z* direction.
C) It is in the positive *x* direction.
D) It is in the negative *x* direction.
E) It is in the positive *z* direction.

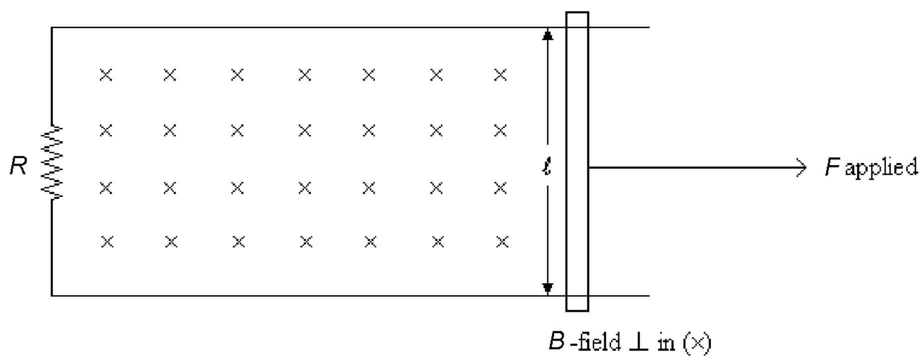
15) Two long, parallel wires carry currents of 4.00 A and 6.00 A. If the distance between the wires is 0.400 m, what is the force per unit length between the wires? 15) ______

A) 16.0 μN/m
B) 2.00 μN/m
C) 38.0 μN/m
D) 5.00 μN/m
E) 12.0 μN/m

16) A circular coil of copper wire is lying flat on a horizontal table. A bar magnet is held with its south pole downward, vertically above the center of the coil. The magnet is kept stationary with respect to the coil. As viewed from above, you can say that the magnet induces 16) ______

A) clockwise current in the loop.
B) an emf but no electric current in the loop.
C) no current in the loop.
D) counterclockwise current in the loop.
E) Not enough information is provided.

Figure 23-9




17) A conducting rod whose length is 25 cm is placed on a U-shaped metal wire that has a resistance *R* of 8 Ω as shown in Figure 23-9. The wire and the rod are in the plane of the paper. A constant magnetic field of strength 0.4 T is applied perpendicular and into the paper. An applied force moves the rod to the right with a constant speed of 6 m/s. What is the magnitude of the induced emf in the wire? 17) ______

A) 0.3 V B) 0.4 V C) 0.2 V D) 0.5 V E) 0.6 V

18) Consider an RLC circuit that is driven by an AC applied voltage. At resonance, 18) ______

A) the current is in phase with the driving voltage.
B) the peak voltage across the resistor is equal to the peak voltage across the inductor.
C) the peak voltage across the resistor is equal to the peak voltage across the capacitor.
D) the peak voltage across the capacitor is greater than the peak voltage across the inductor.
E) the peak voltage across the inductor is greater than the peak voltage across the capacitor.

19) The inductive reactance of a 20.0-mH inductor at a certain frequency is 120 $\Omega$. What is the frequency in Hz? 19) ______

A) 955 Hz B) 167 Hz C) 478 Hz D) 6000 Hz E) 120 Hz

20) In an electromagnetic wave the $\vec{E}$ and $\vec{B}$ fields are oriented such that 20) ______

A) they are perpendicular to one another and perpendicular to the direction of wave propagation.
B) they are perpendicular to one another and parallel to the direction of wave propagation.
C) they are parallel to one another and parallel to the direction of wave propagation.
D) they are parallel to one another and perpendicular to the direction of wave propagation.
E) None of the above answers is correct.

21) The value of the electric field for a certain type of electromagnetic wave is 570 N/C. What is the value of the magnetic field for that wave? 21) ______

A) $1.10 \times 10^{-6}$ T
B) $2.41 \times 10^{-6}$ T
C) $1.90 \times 10^{-6}$ T
D) $2.91 \times 10^{-6}$ T
E) $1.41 \times 10^{-6}$ T

22) At a quiet pond with crystal clear water, you decide to fish with bow and arrow. When you aim at the fish you see, you must aim 22) ______

A) deeper then you perceive the fish to be.
B) directly at the fish.
C) closer to the surface then you perceive the fish to be.
D) It depends on how large the fish is.
E) It depends on how deep the pond is.

23) An object is placed 21 cm from a concave lens of focal length 25 cm. What is the magnification? 23) ______

A) -0.22 B) -0.32 C) 0.22 D) -0.54 E) 0.54

24) A little known fact is that both Robinson Crusoe and Friday wore eyeglasses. As it so happens, Robinson Crusoe was farsighted while Friday was nearsighted. Whose eyeglasses did they use whenever they wanted to start a fire by focusing the Sun's rays? 24) ______

A) Robinson Crusoe's
B) Friday's
C) Both would work equally well.
D) Both actually worked, but Friday's was a little bit better.
E) Neither's worked, they were in possession of matches.

25) Which one of the following mathematical expressions is correct for destructive interference for two beams of light in the double slit experiment? 25) ______

A) Path Difference = $m\lambda$, $m = 0, \pm1, \pm2, \ldots$
B) Path Difference = $m\lambda^2$, $m = 0, \pm1, \pm2, \ldots$
C) Path Difference = $\lambda/m$, $m = 0, \pm1, \pm2, \ldots$
D) Path Difference = $(m - 1/2)\,\lambda$, $m = 0, \pm1, \pm2, \ldots$
E) Path Difference = $m/\lambda$, $m = 0, \pm1, \pm2, \ldots$

26) The length of a telescope is 2.00 m and the focal length of the objective is 2.0 cm. What is the focal length of the eyepiece? 26) _______

A) 101 cm B) 198 cm C) 202 cm D) 2.0 cm E) 200 cm

27) A single slit, which is 0.050 mm wide, is illuminated by light of 550 nm wavelength. What is the angular separation between the first two minima on either side of the central maximum? 27) _______

A) 0.47° B) 1.3° C) 0.36° D) 0.54° E) 0.63°

28) If a hydrogen atom originally in a state with principal quantum number $n$ is excited to state $n' = 2n$, then 28) _______

A) its radius will quadruple and the binding energy will double.
B) its radius will double and the binding energy will quadruple.
C) its radius and binding energy will quadruple.
D) its radius will quadruple and the binding energy will be reduced by a factor of four.
E) its radius and binding energy will double.

29) When an unstable nucleus decays by emitting an alpha particle, the atomic number of the nucleus 29) _______

A) increases by 4.
B) decreases by 4.
C) decreases by 2.
D) increases by 2.
E) remains unchanged.

30) Carbon-14 has a half-life of 5730 years. A sample of wood has been recovered by an archaeologist. The sample is sent to a laboratory, where it is determined that the activity of the sample is 0.144 Bq/g. By comparing this activity with the activity of living organic matter, 0.230 Bq/g, the scientist determines how old the wood sample is, or more precisely, when the tree that the sample came from died. How old is the sample of wood? 30) _______

A) 4250 years
B) 2940 years
C) 2630 years
D) 4590 years
E) 3870 years