Review Questions
PHYS 2426
Exam 2

1. If 4.7×10^{16} electrons pass a particular point in a wire every second, what is the current in the wire?
   A) 4.7 mA B) 7.5 A C) 2.9 A D) 7.5 mA E) 0.29 A
   Ans: D

2. The current in a wire varies with time according to the relation

$$I = 4 + 3t^2$$

   where I is in amperes and t is in seconds. The number of coulombs of charge that pass a cross section of the wire between $t = 3$ s and $t = 5$ s is
   A) 12 B) 48 C) 52 D) 106 E) 305
   Ans: D

5. For copper, $\rho = 8.93$ g/cm^3 and $M = 63.5$ g/mol. Assuming one free electron per copper atom, what is the drift velocity of electrons in a copper wire of radius 0.625 mm carrying a current of 3 A?
   A) 3.54×10^{-4} m/s
   B) 1.80×10^{-4} m/s
   C) 4.26×10^{-4} m/s
   D) 7.52×10^{-4} m/s
   E) 2.46×10^{-4} m/s
   Ans: B

12. The drift velocity of an electron in a wire varies
   A) directly with the number of charge carriers per unit volume.
   B) directly with the cross-sectional area of the conducting wire.
   C) directly with the charge carried carried by it.
   D) directly with the current flowing in the conducting wire.
   E) inversely with the current flowing in the conducting wire.
   Ans: D

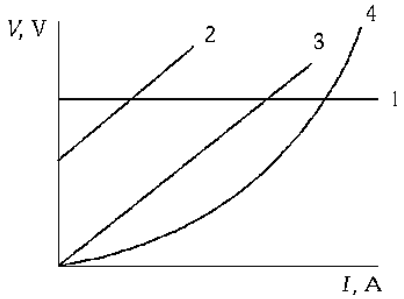
13. The seemingly instantaneous propagation of electric current in a wire when a switch is closed can be understood in terms of
   A) the propagation of an electric field down the wire with nearly the speed of light.
   B) the acquisition of the drift velocities of the free electrons almost immediately.
   C) a very large number of charges slowly drifting down the wire.
   D) the replacement of charge flowing out of the wire at one end by charge entering the wire at the other end.
   E) all of the above.
   Ans: E

14. The resistivity of any given metal
    A) depends on its temperature.
    B) varies nearly linearly with temperature.
    C) is the proportionality constant between the resistance, *R*, and the ratio of the length, *L*, to the cross-sectional area, *A*, of a wire made of the metal.
    D) has units of ohm-meter.
    E) is described by all of the above.
    Ans: E

18. You want to use a metal bar as a resistor. Its dimensions are 2 by 4 by 10 units. To get the smallest resistance from this bar, you should attach leads to the two opposite sides that have the dimensions of
    A) 2 by 4 units.
    B) 2 by 10 units.
    C) 4 by 10 units.
    D) any number of units because all connections give the same resistance.
    E) None of these is correct.
    Ans: C

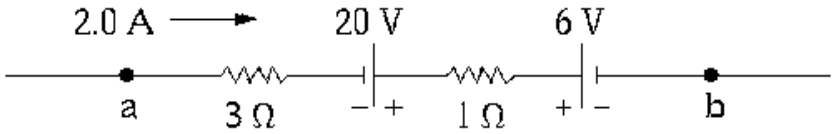
21. A potential difference of 120 V produces a current of 8.0 A in the heating element of a toaster. What is the resistance of this heating element while the toaster is carrying this current?
    A) $6.7 \times 10^{-2}\ \Omega$ B) $15\ \Omega$ C) $0.96\ \text{k}\Omega$ D) $67\ \Omega$ E) $30\ \Omega$
    Ans: B

24.



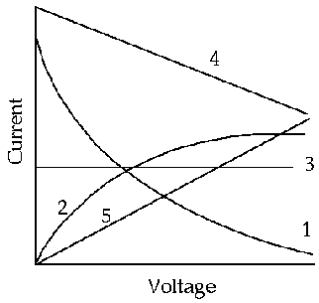
The curves on the graph represent the current versus the potential difference for various conductors. The conductor whose behavior is described by Ohm's law is
A) 1 B) 2 C) 3 D) 4 E) None of these is correct.
Ans: C

27.



If a current of 2.0 A is flowing from point a to point b, the potential difference between the points is
A) 6 V B) 8 V C) 14 V D) 20 V E) 22 V
Ans: A

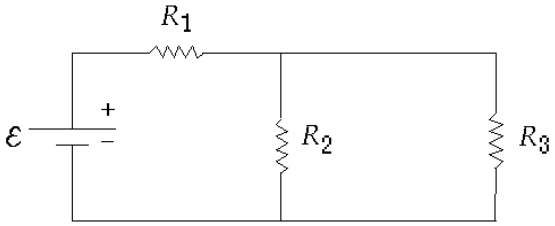
31.



The curve that best illustrates the relation between the current in a metallic conductor and the potential difference between its terminals is
A) 1 B) 2 C) 3 D) 4 E) 5
Ans: E

38. Suppose instead of using a 12-gauge (diameter = 2.05 mm) solid copper cable you made a hollow copper cable of outer diameter 2.59 mm (10-gauge) and inner diameter 1.29 mm (16-gauge). Calculate the length of hollow cable that would give the same resistance as 1 m of 12-gauge solid cable. Use ρ(Cu) = 1.7 x 10^{-8} Ω /m.
A) 0.402 m B) 2.48 m C) 0.833 m D) 1.44 m E) 1.20 m
Ans: E

46.

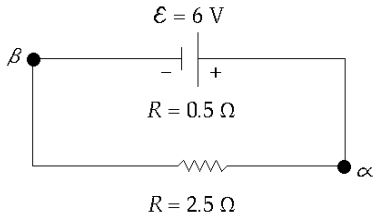


A comparison of the power losses (P_1, P_2, or P_3) in the resistors of the circuit in the diagram shows that, if $R_1 = R_2 = R_3$,

A) $4P_1 = P_2 = P_3$
B) $P_1 = 2P_2 + 2P_3$
C) $P_1 = P_2 = P_3$
D) $P_1 = (1/2)P_2 = (1/2)P_3$
E) $P_1 = P_2 + P_3$

Ans: B

52.



The circuit in the figure contains a battery and a resistor in series. Which of the following statements is not true?

A) The current in the circuit is 2 A.
B) Point α is at a higher potential than point β, and $V_{\alpha\beta} = 5$ V.
C) The battery is supplying energy to the circuit at the rate of 6 W.
D) The rate of heating in the external resistor is 10 W.
E) The battery is being discharged.

Ans: C

58. An electric generator supplies power as a function of time according to the expression

$$P(t) = 2t + 3t^2$$

where the units are SI. The electric energy provided by the generator between $t = 0$ and $t = 1$ s is

A) 1.8 J B) 2.0 J C) 2.5 J D) 5.0 J E) 8.0 J

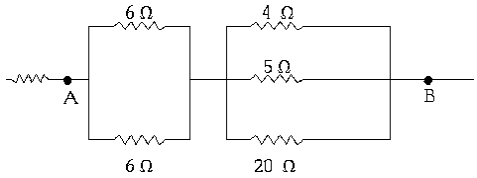
Ans: B

59. You leave your 120-W light bulb on in your room by mistake while you are at school for 8.5 hours. If the price of electrical energy is \$0.085 per kilowatt-hour, how much did it cost you?

A) \$0.082 B) \$0.075 C) \$0.065 D) \$0.087 E) \$0.078

Ans: D

64.

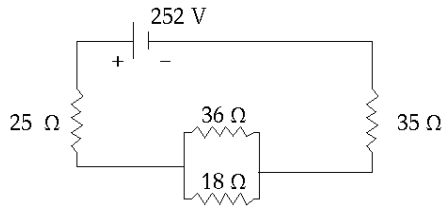


A current of 1.2 A flows from A to B. Therefore, the magnitude of the potential difference between points A and B is approximately

A) 1.0 V B) 4.2 V C) 4.6 V D) 6.0 V E) 20 V

Ans: D

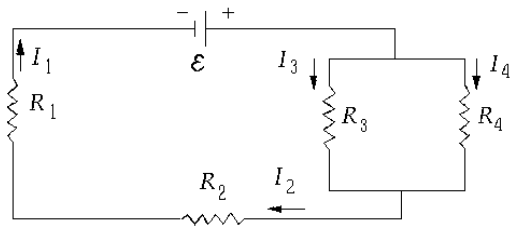
68.



In the circuit shown, the power dissipated in the 18-Ω resistor is
A) 0.15 kW B) 98 W C) 33 W D) 0.33 kW E) 47 W
Ans: B

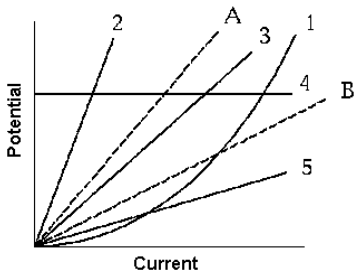
72. When two resistors are connected in series, the equivalent resistance is $R_s = 10\ \Omega$. When they are connected in parallel, the equivalent resistance is $R_p = 2.4\ \Omega$. What are the values of the two resistances?
A) 4.0 Ω and 6.0 Ω
B) 5.0 Ω for both
C) 1.0 Ω and 1.4 Ω
D) 1.2 Ω for both
E) 2.5 Ω and 7.5 Ω
Ans: A

78.



Which of the following relations among the quantities in the figure is generally correct?
A) $I_1R_1 = I_2R_2$
B) $I_3R_3 = I_4R_4$
C) $I_1R_1 = I_4R_4$
D) $I_3R_4 = I_4R_3$
E) $I_1R_1 + I_2R_2 = 0$
Ans: B

80.

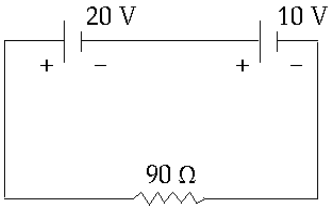


The dashed lines represent graphs of the potential as a function of the current for two resistors A and B, respectively. The curve that might reasonably represent a graph of the data taken when the resistors are connected in series is

A) 1 B) 2 C) 3 D) 4 E) 5

Ans: B

85.

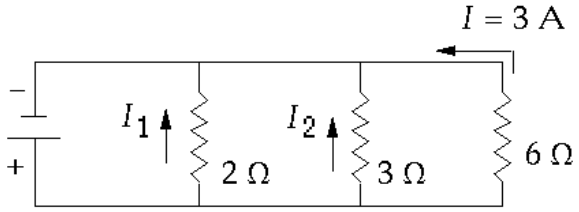


In this circuit, two batteries, one with a potential difference of 10 V and the other with a potential difference of 20 V, are connected in series across a resistance of 90 Ω. The current in the circuit is

A) 3.0 A B) 0.33 A C) 9.0 A D) 30 A E) 4.5 A

Ans: B

94.



You connect resistors of 2 Ω, 3 Ω, and 6 Ω in parallel across a battery. The current through the 6-Ω resistor is 3 A. What are the currents in the other two resistors?

A) $I_1 = 9$ A; $I_2 = 6$ A

B) $I_1 = 6$ A; $I_2 = 9$ A

C) $I_1 = 1$ A; $I_2 = 1.5$ A

D) The answer cannot be obtained without knowing the emf of the battery.

E) None of these is correct.

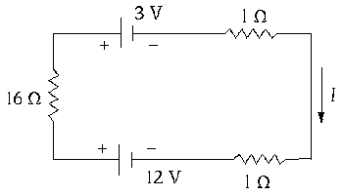
Ans: A

96. The conservation of energy in an electric circuit is closely related to which of the following?

A) Ohm's law
B) Kirchhoff's junction rule
C) Kirchhoff's loop rule
D) Newton's laws
E) Ampère's law

Ans: C

97.



What is the current through the circuit in the figure?

A) +0.83 A B) –0.50 A C) +0.50 A D) +0.55 A E) –0.92 A

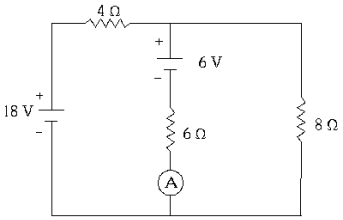
Ans: C

99. The conservation of charge in an electric circuit is closely related to which of the following?

A) Ohm's law
B) Kirchhoff's junction rule
C) Kirchhoff's loop rule
D) Newton's laws
E) Ampère's law

Ans: B

106.

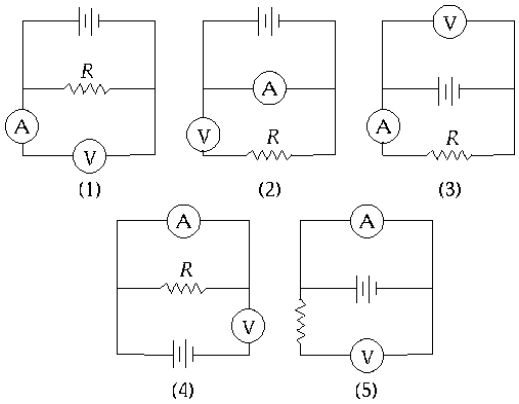


In this circuit, the batteries have negligible internal resistance and the ammeter has negligible resistance. The current through the ammeter is

A) 0.30 A B) 0.69 A C) 2.1 A D) 4.2 A E) 3.6 A

Ans: B

108.

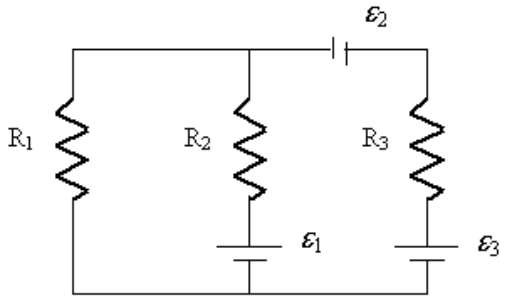


The circuit in which the voltmeter Ⓥ and the ammeter Ⓐ are correctly arranged to determine the value of the unknown resistance *R* is

A) 1 B) 2 C) 3 D) 4 E) 5

Ans: C

121.

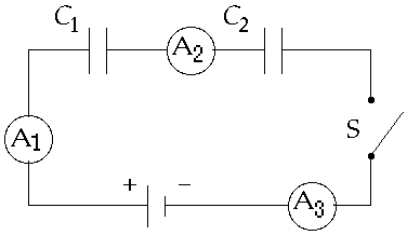


In the above circuit, ξ_1 = 9 V, ξ_2 = 6 V, and ξ_3 = 6 V. Also R_1 = 25 Ω, R_2 = 125 Ω, and R_3 = 55 Ω. Find the current flowing through R_3.

A) 0.60 A B) 0.072 A C) 0.68 A D) 0.36 A E) 0.020 A

Ans: E

125.



Capacitors C_1 and C_2 are connected in series to the battery as shown. When you close switch S, a momentary current is indicated by

A) ammeter A_1 only.
B) ammeter A_2 only.
C) ammeter A_3 only.
D) ammeter A_1 and A_3 only.
E) all of the ammeters.

Ans: E

1. A charged particle is moving horizontally westward with a velocity of 3.5×10^{6} m/s in a region where there is a magnetic field of magnitude 5.6×10^{-5} T directed vertically downward. The particle experiences a force of 7.8×10^{-16} N northward. What is the charge on the particle?
   A) $+4.0 \times 10^{-18}$ C
   B) -4.0×10^{-18} C
   C) $+4.9 \times 10^{-5}$ C
   D) -1.2×10^{-14} C
   E) $+1.4 \times 10^{-11}$ C
   Ans: B

4. The phenomenon of magnetism is best understood in terms of
   A) the existence of magnetic poles.
   B) the magnetic fields associated with the movement of charged particles.
   C) gravitational forces between nuclei and orbital electrons.
   D) electrical fluids.
   E) None of these is correct.
   Ans: B

5. A wire 30 cm long with an east–west orientation carries a current of 3.0 A eastward. There is a uniform magnetic field perpendicular to this wire. If the force on the wire is 0.18 N upward, what are the direction and magnitude of the magnetic field?
   A) 0.20 T up
   B) 0.20 T north
   C) 0.20 T south
   D) $2.0 \square 10^{-3}$ T north
   E) $2.0 \square 10^{-3}$ T up
   Ans: B

10. The magnetic force on a charged particle
   A) depends on the sign of the charge on the particle.
   B) depends on the velocity of the particle.
   C) depends on the magnetic field at the particle's instantaneous position.
   D) is at right angles to both the velocity and the direction of the magnetic field.
   E) is described by all of these.
   Ans: E

11. An alpha particle has a charge of +2*e* ($e = 1.6 \square 10^{-19}$ C) and is moving at right angles to a magnetic field $B = 0.27$ T with a speed $v = 6.15 \square 10^{5}$ m/s. The force acting on this charged particle is

A) zero
B) 5.3×10^{-14} N
C) 3.3×10^{5} N
D) 2.7×10^{-14} N
E) 4.8×10^{5} N

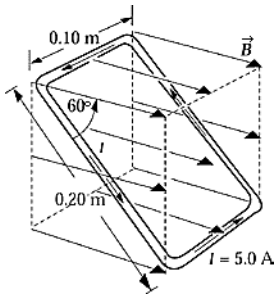
Ans: B

14. A long straight wire parallel to the *y* axis carries a current of 6.3 A in the positive *y* direction. There is a uniform magnetic field $\vec{B} = 1.5\text{ T}\ \hat{i}$. The force per unit length on the wire is approximately

A) $6.3\text{ N/m}\ \hat{k}$
B) $-9.5\text{ N/m}\ \hat{k}$
C) $-6.3\text{ N/m}\ \hat{k}$
D) $9.5\text{ N/m}\ \hat{k}$
E) $1.5\text{ N/m}\ \hat{k}$

Ans: B

16.



A rectangular loop of wire (0.10 m by 0.20 m) carries a current of 5.0 A in a counterclockwise direction. The loop is oriented as shown in a uniform magnetic field of 1.5 T. The force acting on the upper 0.10-m side of the loop is

A) 1.5 N B) 0.75 N C) 0.50 N D) 0.15 N E) zero

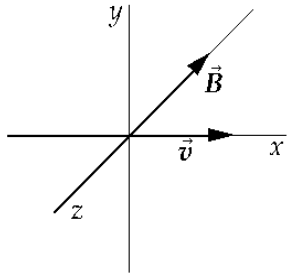
Ans: B

20. A beam of electrons ($q = 1.6 \times 10^{-19}$ C) is moving through a region of space in which there is an electric field of intensity 3.4×10^{4} V/m and a magnetic field of 2.0×10^{-3} T. The electric and magnetic fields are so oriented that the beam of electrons is not deflected. The velocity of the electrons is approximately

A) 6.8×10^{6} m/s
B) 3.0×10^{8} m/s
C) 6.0×10^{-9} m/s
D) 0.68 km/s
E) 1.7×10^{7} m/s

Ans: E

23.



A positively charged particle moves with velocity $v\hat{i}$ along the x axis. A uniform magnetic field $-B\hat{k}$ exists in the negative z direction. You want to balance the magnetic force with an electric field so that the particle will continue along a straight line. The electric field should be in the

A) positive x direction.
B) positive z direction.
C) negative y direction.
D) negative x direction.
E) negative z direction.

Ans: C

28. An alpha particle of charge +2e and mass 4(1.66 x 10^{-27}) kg, and an ^{16}O nucleus of charge +8e and mass 16(1.66 x 10^{-27}) kg have been accelerated from rest through the same electric potential. They are then injected into a uniform magnetic field $\vec{B}$, where both move at right angles to the field. The ratio of the radius of the path of the alpha particle to the radius of the path of the nucleus ^{16}O is

A) $r_{\square}/r_{O}$ = 1/1
B) $r_{\square}/r_{O}$ = 1/4
C) $r_{\square}/r_{O}$ = 1/8
D) $r_{\square}/r_{O}$ = 1/2
E) None of these is correct.

Ans: A

29. An electron is accelerated from rest by an electric field. After the acceleration, the electron is injected into a uniform magnetic field of 1.27 x 10^{-3} T. The velocity of the electron and the magnetic field lines are perpendicular to one another. The electron remains in the magnetic field for 5.00 □ 10^{-9} s. The angle between the initial electron velocity and the final electron velocity is

A) 1.1 rad
B) 5.8 x 10^{-2} rad
C) 8.68 x 10^{-2} rad
D) 6.5 x 10^{-2} rad
E) 2.3 rad

Ans: A

33. The radius of curvature of the path of a charged particle moving perpendicular to a magnetic field is given by

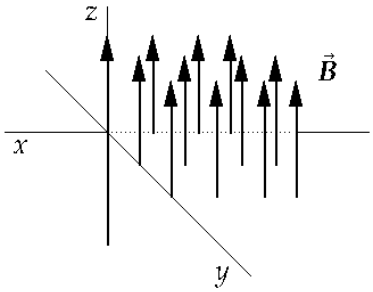
A) qE/m B) $Bm/(qv)$ C) $Bv/(qm)$ D) $mv/(qB)$ E) $Bq/(mv)$

Ans: D

36. All of the charged particles that pass through crossed electric and magnetic fields without deflection have the same
A) mass. B) speed. C) momentum. D) energy. E) charge-to-mass ratio.
Ans: B

38. A small positively charged body is moving horizontally and westward. If it enters a uniform horizontal magnetic field that is directed from north to south, the body is deflected
A) upward.
B) downward.
C) toward the north.
D) toward the south.
E) not at all.
Ans: A

40.



A uniform magnetic field is parallel to and in the direction of the positive *z* axis. For an electron to enter this field and not be deflected by the field, the electron must be traveling in which direction?
A) any direction as long as it is in the *xy* plane.
B) any direction as long as it is in the *xz* plane.
C) along the positive *x* axis.
D) along the positive *y* axis.
E) along the positive z axis.
Ans: E

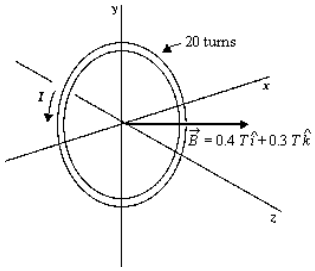
46. A beam of electrons moving at a speed of 8×10^4 m/s is undeflected when it passes through an electric field of 5 N/C perpendicular to its path and a magnetic field that is perpendicular to its path and also to that of the electric field. Calculate the strength of the magnetic field.
A) 1.60×10^4 T
B) 6.25×10^{-5} T
C) 7.81×10^{-10} T
D) 3.13×10^{-5} T
E) 1.25×10^{-4} T
Ans: B

53. A small permanent magnet is placed in a uniform magnetic field of magnitude 0.35 T. If the maximum torque experienced by the magnet is 0.50 N · m, what is the magnitude of the magnetic moment of the magnet?

A) 1.4 A · m^2
B) 0.70 A · m^2
C) 0.18 A · m^2
D) 2.8 A · m^2
E) 0.35 A · m^2

Ans: A

58.



A circular 20-turn coil with a radius of 10 cm carries a current of 3 A. It lies in the *xy* plane in a uniform magnetic field $\vec{B} = 0.4\text{ T}\,\hat{i} + 0.3\text{ T}\,\hat{k}$. The potential energy of the system is

A) –0.263 J B) –0.461 J C) –0.564 J D) 0.564 J E) 0.461 J

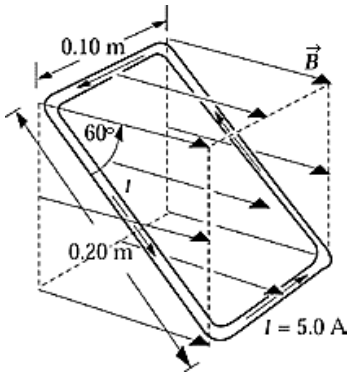
Ans: C

62. Which of the following statements correctly describes the torque-potential energy relationship for a current-carrying coil in a uniform magnetic field?

A) The maximum potential energy occurs for the same orientation of magnetic dipole and the magnetic field that corresponds to maximum torque.
B) The potential energy of the system is constant.
C) The torque rotates the coil toward a position of lower potential energy.
D) The torque rotates the coil toward a position of higher potential energy.
E) None of these is correct.

Ans: C

63.

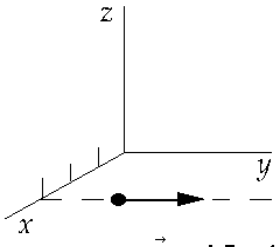


A rectangular loop of wire (0.10 m by 0.20 m) carries a current of 5.0 A in a counterclockwise direction. The loop is oriented as shown in a uniform magnetic field. The magnetic dipole moment associated with this loop has a value of

A) 0.026 A · m^2
B) 0.030 A · m^2
C) 0.10 A · m^2
D) 0.50 A · m^2
E) 1.5 A · m^2

Ans: C

1.



$\vec{v} = 4.5 \times 10^{7}\ \mathrm{m/s}\ \hat{j}$

A point charge of q_1 = 3.6 nC is moving with speed 4.5 x 10^7 m/s parallel to the y axis along the line x = 3 m. The magnetic field produced by this charge at the origin when it is at the point x = 3 m, y = 4 m is approximately

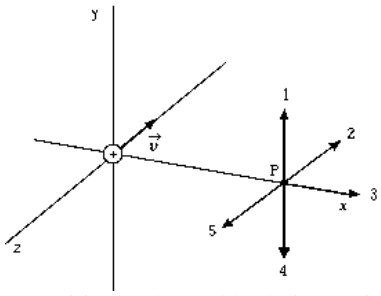
A) 0.39 nT $\hat{k}$ B) –0.78 nT $\hat{k}$ C) –0.39 nT $\hat{k}$ D) 0.78 nT $\hat{k}$ E) 2.0 nT $\hat{k}$

Ans: A

5. The magnitude of the magnetic field due to the presence of a charged body
   A) varies directly with the speed of the body.
   B) varies directly with the charge carried by the body.
   C) varies inversely with the square of the distance between the charged body and the field point.
   D) depends on the magnetic properties of the space between the charged body and the field point.
   E) is described by all of these.

   Ans: E

7.

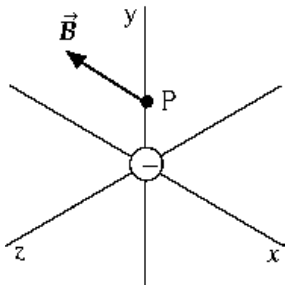


A positively charged body is moving in the negative *z* direction as shown. The direction of the magnetic field due to the motion of this charged body at point P is

A) 1 B) 2 C) 3 D) 4 E) 5

Ans: D

.

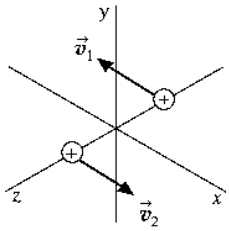


At the instant the negatively charged body is at the origin, the magnetic field at point P due to its motion is in the negative *x* direction. The charged body must be moving

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

Ans: A

11.

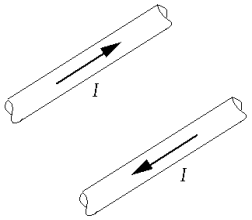


Two positively charged bodies are moving in opposite directions on parallel paths that lie in the *xz* plane. Their speeds are equal and their trajectories are equidistant from the *x* axis. The magnetic field at the origin, due to the motion of these charged bodies will be

A) in the *x* direction.
B) in the *y* direction.
C) in the *y* direction.
D) in the *z* direction.
E) zero.

Ans: B

14.



Two wires lying in the plane of this page carry equal currents in opposite directions, as shown. At a point midway between the wires, the magnetic field is

A) zero.
B) into the page.
C) out of the page.
D) toward the top or bottom of the page.
E) toward one of the two wires.

Ans: B

15. What is the direction of the magnetic field around a wire carrying a current perpendicularly into this page?

A) The field is parallel to and in the same direction as the current flow.
B) It is parallel to but directed opposite to the current flow.
C) It is counterclockwise around the wire in the plane of the page.
D) It is clockwise around the wire in the plane of the page.
E) None of these is correct.

Ans: D

17. The Biot–Savart law is similar to Coulomb's law in that both

A) are inverse square laws.
B) include the permeability of free space.
C) deal with excess charges.
D) are not electrical in nature.
E) are described by none of the above.

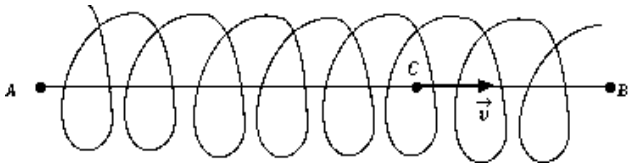
Ans: A

18. Two current-carrying wires are perpendicular to each other. The current in one flows vertically upward and the current in the other flows horizontally toward the east. The horizontal wire is 1 m south of the vertical wire. What is the direction of the net magnetic force on the horizontal wire?

A) north
B) east
C) west
D) south
E) There is no net magnetic force on the horizontal wire.

Ans: E

20.



A solenoid carries a current *I*. An electron is injected with velocity $\vec{v}$ along the axis *AB* of the solenoid. When the electron is at *C*, it experiences a force that is

A) zero.
B) not zero and along *AB*.
C) not zero and along *BA*.
D) not zero and perpendicular to the page.
E) None of these is correct.

Ans: A

22. At great axial distances *x* from a current-carrying loop the magnetic field varies as

A) x^2 B) x^{-3} C) x^{-2} D) x^3 E) x^{-1}

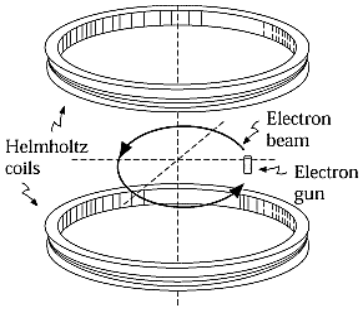
Ans: B

25. In a circular loop of wire lying on a horizontal floor, the current is constant and, to a person looking downward, has a clockwise direction. The accompanying magnetic field at the center of the circle is directed

A) horizontally and to the east.
B) horizontally and to the north.
C) vertically upward.
D) parallel to the floor.
E) vertically downward.

Ans: E

27.



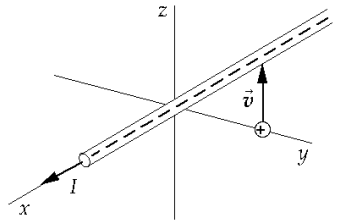
An electron beam travels counterclockwise in a circle of radius *R* in the magnetic field produced by the Helmholtz coils as shown. If you increase the current in the Helmholtz coils, the electron beam will

A) increase its radius.
B) decrease its radius.
C) maintain the same radius.
D) reverse and travel clockwise with the same radius.
E) reverse and travel clockwise with a larger radius.

Ans: B

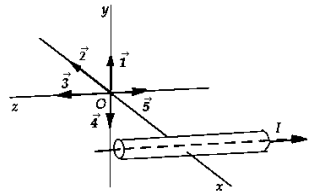
30. A circular loop of wire of radius 6.0 cm has 30 turns and lies in the *xy* plane. It carries a current of 5 A in such a direction that the magnetic moment of the loop is along the *x* axis. The magnetic field on the *x* axis at $x = 6.0$ cm is approximately
A) 19 μT B) 0.56 mT C) 0.11 mT D) 47 μT E) 0.88 mT
Ans: B

33.



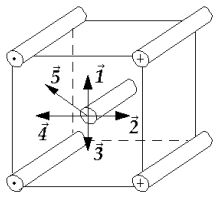
The current in a wire along the *x* axis flows in the positive *x* direction. If a proton, located as shown in the figure, has an initial velocity in the positive *z* direction, it experiences
A) a force in the direction of positive *x*.
B) a force in the direction of negative *x*.
C) a force in the direction of positive *z*.
D) a force in the direction of positive *y*.
E) no force.
Ans: E

35.



A long conductor carrying current *I* lies in the *xz* plane parallel to the *z* axis. The current travels in the negative *z* direction, as shown in the figure. The vector that represents the magnetic field at the origin *O* is
A) $\vec{1}$ B) $\vec{2}$ C) $\vec{3}$ D) $\vec{4}$ E) $\vec{5}$
Ans: A

37.

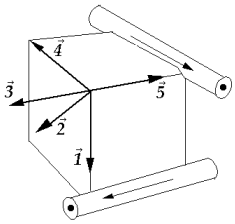


Four wires carry equal currents along the four parallel edges of a cube. A parallel current-carrying wire through the center of the cube is free to move. The vector that might represent the direction in which the center wire will move is

A) $\vec{1}$ B) $\vec{2}$ C) $\vec{3}$ D) $\vec{4}$ E) $\vec{5}$

Ans: B (If I is into the page); D (If I is out of the page.)

38.

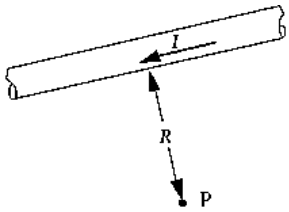


Current-carrying wires are located along two edges of a cube with the directions of the currents as indicated. The vector that indicates the resultant magnetic field at the corner of the cube is

A) $\vec{1}$ B) $\vec{2}$ C) $\vec{3}$ D) $\vec{4}$ E) $\vec{5}$

Ans: B

40.



The magnetic field at point P, due to the current in the very long wire, varies with distance R according to

A) R^2 B) R^{-3} C) R^{-2} D) R^3 E) R^{-1}

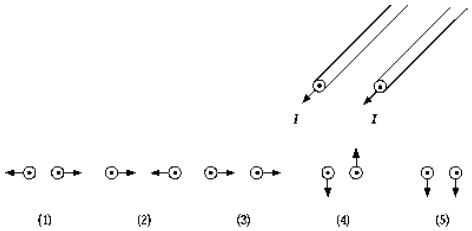
Ans: E

42. The force per unit length between two current-carrying wires is expressed as

$$F/l = (\mu_0/2\pi d)I^2$$

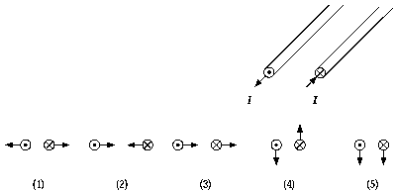
where I is the current, d the separation of the wires, and l the length of each wire. A plot of force per unit length versus I^2 gives a straight line, the slope of which is
A) μ_0 B) F/l C) $(2\pi d/\mu_0)^{1/2}$ D) $\mu_0/2\pi d$ E) FI^2/l
Ans: D

45.



Two very long, parallel conducting wires carry equal currents in the same direction, as shown. The numbered diagrams show end views of the wires and the resultant force vectors due to current flow in each wire. Which diagram best represents the direction of the forces?
A) 1 B) 2 C) 3 D) 4 E) 5
Ans: B

46.

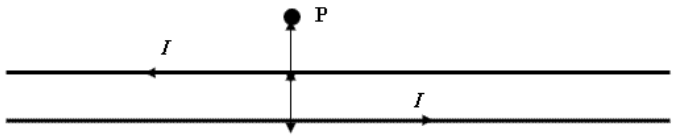


Two very long, parallel conducting wires carry equal currents in opposite directions. The numbered diagrams show end views of the wires and the resultant force vectors due to current flow in each wire. Which diagram best represents the direction of the forces?
A) 1 B) 2 C) 3 D) 4 E) 5
Ans: A

47. Two straight rods 60 cm long and 2.0 mm apart in a current balance carry currents of 18 A each in opposite directions. What mass must be placed on the upper rod to balance the magnetic force of repulsion?
A) 0.50 g B) 0.99 g C) 9.7 g D) 4.3 g E) 1.6 g
Ans: B

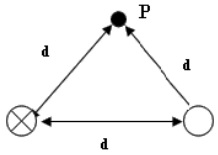
50. If the magnetic field at the center of a square current loop of side L = 40 cm is 2.4 x 10^{-6} T calculate the current flowing around the loop.
A) 11 A B) 3.4 A C) 0.85 A D) 0.21 A E) 1.7 A
Ans: C

53.



Calculate the magnetic field and its direction at point P, which is 2.0 cm away from the top wire and 4.0 cm from the bottom wire. Assume both wires are infinitely long and each carries a current of 1.5 A.
A) 2.3 □ 10^{-5} T directed OUT of the page
B) 7.5 □ 10^{-6} T directed INTO the page
C) 2.3 □ 10^{-5} T directed INTO the page
D) 7.5 □ 10^{-6} T directed OUT of the page
E) 1.1 □ 10^{-5} T directed OUT of the page
Ans: B

56.

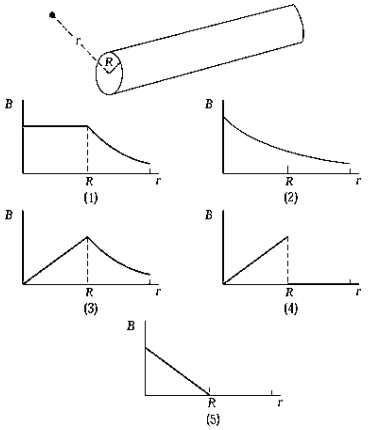


Two long parallel wires are a distance d apart (d = 6 cm) and carry equal and opposite currents of 5 A. Point P is distance d from each of the wires. Calculate the magnitude of the magnetic field strength at point P.
A) 2.9 x 10^{-5} T
B) 8.5 x 10^{-6} T
C) 3.3 x 10^{-5} T
D) 1.7 x 10^{-5} T
E) None of the above
Ans: D

58. Gauss's law for magnetism summarizes the fact(s) that
A) the magnetic flux through a closed surface is zero.
B) the magnetic flux is given by $\oint_S B\, dA$.
C) the existence of magnetic monopoles has yet to be verified.
D) there is no point in space from which magnetic field lines diverge.
E) all of the above are true.
Ans: E

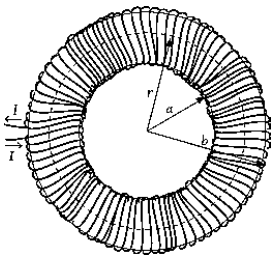
59. Ampère's law is valid
   A) when there is a high degree of symmetry in the geometry of the situation.
   B) when there is no symmetry.
   C) when the current is constant.
   D) when the magnetic field is constant.
   E) for all of these conditions.
   Ans: E

61.



The graph that best represents B as a function of r for a wire of radius R carrying a current I uniformly distributed over its cross-sectional area is
A) 1 B) 2 C) 3 D) 4 E) 5
Ans: C

Use the following to answer questions 65-67:



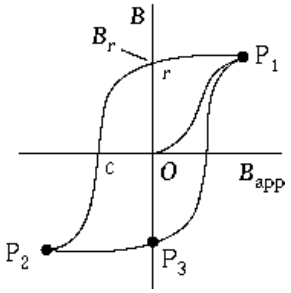
65. The tightly wound toroid shown consists of 100 turns of wire, each carrying a current I = 3 A. If a = 12 cm and b = 15 cm, the magnetic field at r = 10 cm, due to the current in this toroid, is ($\mu_0 = 4\square \times 10^{-7}$ N/A^2)
A) 400 μT
B) 500 μT
C) 600 μT
D) zero
E) impossible to calculate without additional information.
Ans: D

77. A cylindrical bar magnet of radius 1.00 cm and length 10.0 cm has a magnetic dipole moment of magnitude $m = 2.00\ \text{A} \cdot \text{m}^2$. What is the magnetic field at the center of the magnet?
A) 125 mT B) 23.0 mT C) 57.0 mT D) 80.0 mT E) 40.0 mT
Ans: D

91. When a sample is inserted into a solenoid carrying a constant current, the magnetic field inside the solenoid increases by 0.005%. What is the magnetic susceptibility of the sample?
A) -5×10^{-5}
B) $+5 \times 10^{-5}$
C) 3.6×10^{-5}
D) -3.6×10^{-5}
E) More information is needed to answer this question.
Ans: B

92. Nickel has a density of 8.70 g/cm^3 and a molecular mass of 58.7 g/mol. Its magnetic moment is 0.587 Bohr magnetons (1 Bohr magneton = $9.27 \times 10^{-24}\ \text{A} \cdot \text{m}^2$). What is its saturation magnetization?
A) 4.85×10^9 A/m
B) 8.92×10^5 A/m
C) 9.27×10^{-24} A/m
D) 8.92×10^{28} A/m
E) 4.85×10^5 A/m
Ans: E

105.

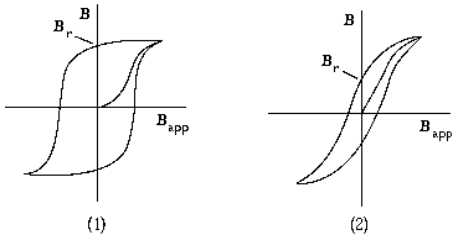


Point P_1 on the hysteresis curve corresponds to

A) approximate saturation.
B) the alignment of nearly all atomic magnetic moments.
C) maximum applied magnetic field.
D) the alignment of virtually all the magnetic domains.
E) All of these are correct.

Ans: E

106.



If you assume that the scalings of the axes of these hysteresis curves are the same, you can conclude that

A) curve 1 is for a magnetically soft material.
B) curve 2 is for a magnetically soft material.
C) curve 2 is for a magnetically hard material.
D) both curves are for a magnetically soft material.
E) both curves are for a magnetically hard material.

Ans: B