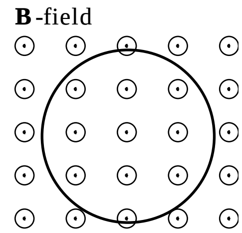
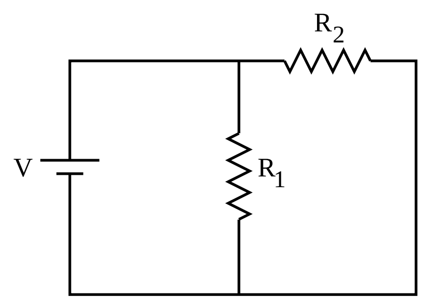
Multiple Choice -- TEST II



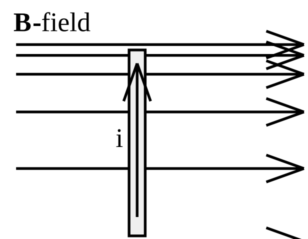
1.) A 50 turn coil whose face area is .5 square meters and whose resistance is $R = 10\ \Omega$ faces a uniform B-field coming out of the page that changes at a rate of -.4 teslas per second. At t = 0, the magnetic field intensity is .25 teslas. The magnitude of the current induced in the coil will be:

a.) 1 amp.
b.) 2 amps.
c.) 4 amps.
d.) None of the above.



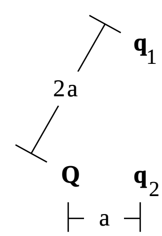
2.) If R_1 is doubled:

a.) The power dissipated by R_2 will decrease.
b.) The power dissipated by R_1 will halve.
c.) The power dissipated by R_1 will quarter.
d.) The power dissipated by R_1 will stay the same.
e.) None of the above.



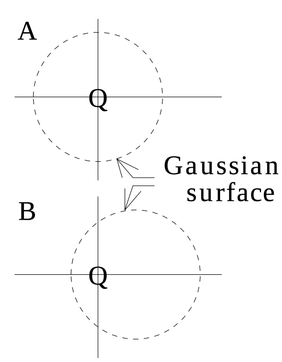
3.) A current-carrying wire is placed in a varying magnetic field as shown. Assuming gravity is zero and the wire is free to move as it will:

a.) The wire will accelerate to the right and spin clockwise relative to the plane of the paper.
b.) The wire will accelerate into the page and spin so that its top rotates into the page.
c.) The wire will accelerate out of the page and spin so that its top rotates out of the page.
d.) None of the above.



4.) Two equal charges q_1 and q_2 (they have been labeled differently for identification purposes) are placed as shown in the vicinity of a third charge Q. We know that the force magnitude q_1 applies to Q is F_1, and the force magnitude q_2 applies to Q is F_2. The ratio of F_1 to F_2 is:

a.) 1 to 2. b.) 2 to 1. c.) 1 to 4. d.) 4 to 1.



5.) A point charge Q is placed at the origin of a coordinate system, and a Gaussian surface is placed around the charge as shown in sketch A. A second, identical situation is set up with the exception that the Gaussian surface is positioned as shown in sketch B.

a.) The electric flux through the two surfaces will be different.

b.) The electric flux through the surface in sketch A will equal Q/ε_o, and the magnitude of the electric field along the x axis in sketch A will be $E = \dfrac{Q}{4\pi\varepsilon_o x^2}$.

c.) The electric flux through the surface in sketch A will be Q/ε_o, and the magnitude of the electric field along the x axis in sketch B will be $E = \dfrac{Q}{4\pi\varepsilon_o x^2}$.

d.) All of the above.

e.) Only b and c are true.

f.) None of the above.

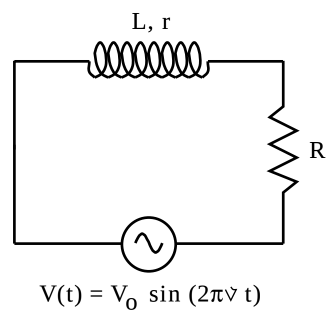
6.) The inductance of the inductor in the circuit shown is 10 mH and its resistor-like resistance is 15 Ω. The load resistor is R = 1000 Ω. At 200 cycles/second, the inductive reactance of the circuit is:

a.) 12.6 Ω.

b.) .08 Ω.

c.) .008 Ω.

d.) None of the above.



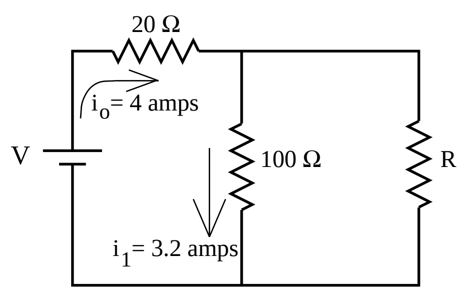
7.) Consider the resistor circuit shown.

a.) The unknown resistor R = 25 Ω, and the voltage V = 80 volts.

b.) The unknown resistor R = 400 Ω, and the voltage V = 200 volts.

c.) The unknown resistor R = 400 Ω, and the voltage V = 400 volts.

d.) None of the above.



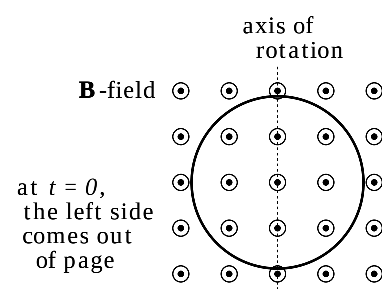
8.) A spinning coil whose axis is in the +j direction sits in a B-field that comes out of the page. The coil's rotation is such that at t = 0, it is in the plane of the page with its left side moving out of the page.

a.) The flux change is a maximum at t = 0, and the induced current's direction is clockwise.

b.) The flux change is a maximum at t = 0, and the induced current's direction is counterclockwise.

c.) The flux change is zero at t = 0, and the induced current's direction just an instant after t = 0 is clockwise.

d.) The flux change is zero at t = 0, and the induced current's direction just after t = 0 is counterclockwise.



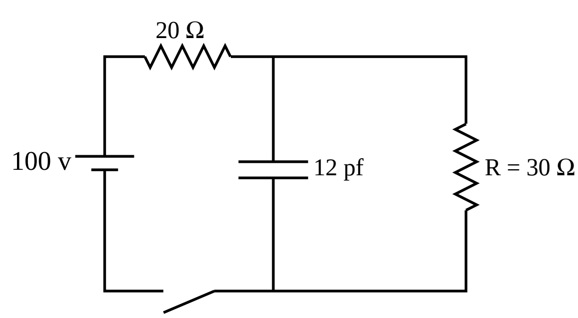
9.) At t = 0, the switch is closed. If the capacitors are initially uncharged, what is the initial current through R?

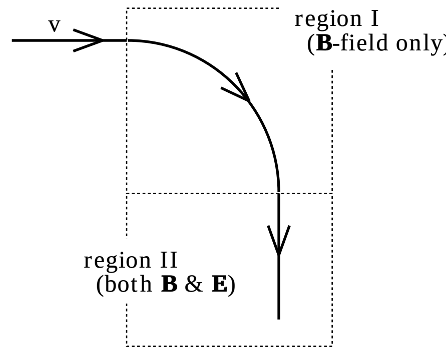
a.) 5 amps.

b.) 2 amps.

c.) 1 amp.

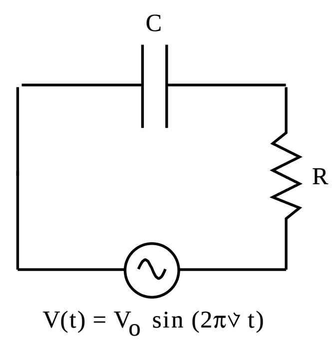
d.) None of the above.





10.) A negative charge moves with known velocity magnitude v into region I in which exists an unknown B-field. It accelerates as shown in the sketch, then enters region II in which there exists not only B but also an unknown electric field E.

a.) The direction of the B-field is toward the bottom of the page, and as there is no need for the presence of an electric field to keep the charge moving in the direction shown in region II, E = 0 .
b.) The direction of the B-field is into the page, and the direction of the E-field is to the left.
c.) The direction of the B-field is into the page, and the direction of the E-field is to the right.
d.) The direction of the B-field is out of the page, and the direction of the E-field is to the left.
e.) The direction of the B-field is out of the page, and the direction of the E-field is to the right.
f.) None of the above.

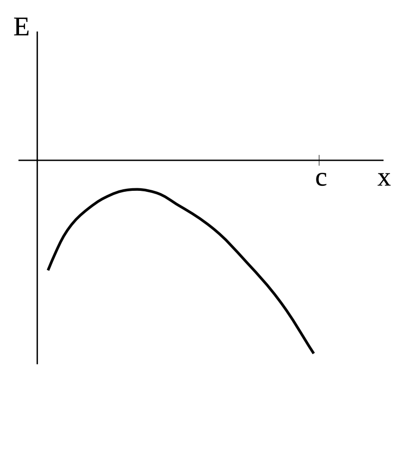


11.) The capacitance of the capacitor in the circuit shown is C = 10 μf . The load resistor is R = 100 Ω. The frequency of the source is 80 cycles/second. The approximate impedance of the circuit is:

a.) 100 Ω.
b.) 220 Ω.
c.) 300 Ω.
d.) None of the above.

12.) A .25 kg mass has a 2 coulomb charge on it. It is placed at Point A in an electric field and released from rest, freely accelerating over a .4 meter distance to Point B where its velocity is observed to be 8 m/s. The electrical potential of B is 40 volts.

a.) The electrical potential at A is 44 volts.
b.) The electrical potential at A is 36 volts.
c.) The electrical potential at A is 40.5 volts.
d.) None of the above.



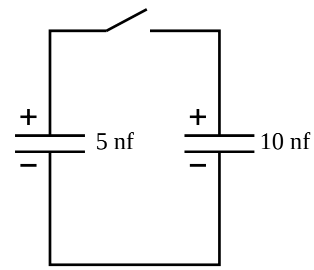
13.) Charge A is placed at the origin and charge B is placed a distance c units down the +x axis. Data is taken between the charges, and a plot of the subsequent electric field E as a function of position x is graphed.

a.) Both charges are positive, and charge A is larger in magnitude.
b.) Charge A is positive, charge B is negative, and charge A is larger in magnitude.
c.) Charge A is negative, charge B is positive, and charge B is larger in magnitude.
d.) Charge A is negative, charge B is positive, and charge B is smaller in magnitude.
e.) None of the above.

14.) A solid sphere has a volume charge density of kr^4, where k is a constant with appropriate units. If the sphere's radius is a:

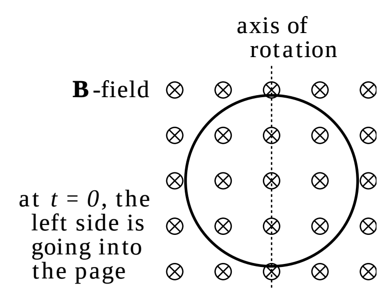
a.) The electric field is smaller at a/2 than it is at a, and it is smaller at a than it is at 2a.
b.) The electric field is smaller at a/2 than it is at a, and it is greater at a than it is at 2a.
c.) The electric field is greater at a/2 than it is at a, and it is smaller at a than it is at 2a.
d.) The electric field is greater at a/2 than it is at a, and it is greater at a than it is at 2a.

15.) A 5 nf capacitor (call it C) is charged by a 50 volt power supply and then isolated. A 10 nf capacitor (call it 2C) is charged by a 100 volt power supply and then isolated. The two capacitors are then connected as shown. At t = 0, the switch is closed. After a long period of time, the voltage across the 5 nf capacitor will be:



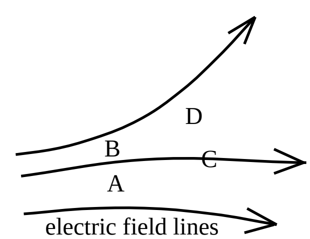
a.) 83.4 volts.
b.) 75 volts.
c.) 66.6 volts.
d.) None of the above.

16.) A coil is rotated in a fixed B-field that is oriented into the page. The angular position of the coil at t = 0 is shown to the right with the coil's left side moving into the page. In the position shown:



a.) The induced current in the coil will be in the counterclockwise direction, relative to the sketch, and the current will be increasing.
b.) The induced current in the coil just after t = 0 will be in the clockwise direction, relative to the sketch, and the current will be decreasing.
c.) The induced current in the coil just after t = 0 will be in the counterclockwise direction, relative to the sketch, and the current will be decreasing.
d.) The induced current in the coil just after t = 0 will be in the clockwise direction, relative to the sketch, and the current will be increasing.

17.) Equal positive charges are placed at Points A, B, C, and D in the E-field shown. When released, which charge will probably travel the farthest in 10 seconds?

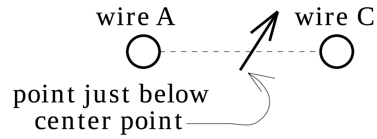


a.) The charge at Point A.
b.) The charge at Point B.
c.) The charge at Point C.
d.) The charge at Point D.

18.) A wire's radius is doubled. With that change, the power dissipated by a given length will:

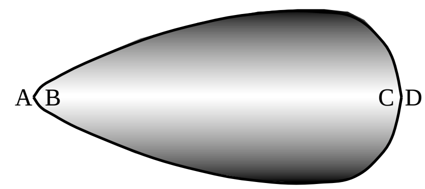
a.) Quarter.
b.) Halve.
c.) Double.
d.) Quadruple.
e.) None of the above.

19.) Two current-carrying wires are oriented perpendicular to the page. Their current magnitudes and directions are unknown. The net magnetic field just below the center point of a line passing between the charges is shown in the sketch.



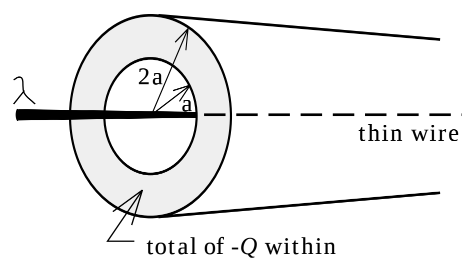
a.) Wire A's current must be into the page with wire C's current being out of the page, and A's current magnitude must be larger than C's.
b.) Both wires A and C must have currents out of the page, and A's current magnitude must be larger than C's.
c.) Wire A's current must be out of the page with wire C's current being into the page, and A's current magnitude must be smaller than C's.
d.) Both wire A's current and C's current must be into the page, and A's current magnitude must be smaller than C's.

20.) The thin-shelled, egg-shaped conductor has a total charge Q placed on it. With points B and C inside the shell's surface:



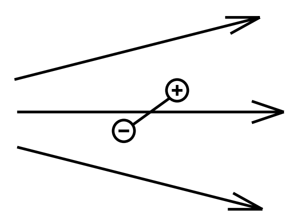
a.) The electric potential at B is greater than at C, and the electric field at A is greater than at D.
b.) The electric potential at B is the same as at C, and the electric field at A is greater than at D.
c.) The electric potential at B is greater than at C, and the electric field at A is the same as at D.
d.) The electric potential at B is smaller than C, and the electric field at A is smaller than at D.

21.) A long, hollow cylinder of inside radius a and outside radius 2a has a thin wire with a linear charge density λ running down its central axis. Additionally, for every meter of length, a negative charge -Q is uniformly sprinkled throughout the volume between a and 2a. It is observed that at (5/4)a, the electric field is zero. The linear charge density function λ must equal:



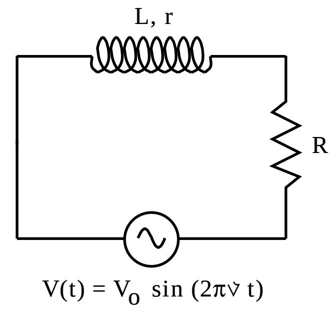
a.) Approximately .188Q coulombs per unit length.
b.) Approximately .212Q coulombs per unit length.
c.) Approximately .590Q coulombs per unit length.
d.) None of the above.

22.) A dipole is placed in an electric field as shown. Over time, the dipole will:

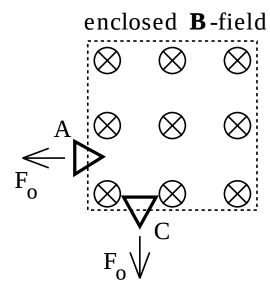


a.) Experience a constant acceleration of its center of mass toward the right and will experience a constant torque that motivates it to angularly accelerate in a clockwise direction.
b.) Experience no acceleration of its center of mass but will experience a varying torque that motivates it to angularly accelerate in a clockwise direction.
c.) Experience a varying acceleration of its center of mass toward the left and will experience a varying torque that motivates it to angularly accelerate in a clockwise direction.

d.) Experience no acceleration but will experience a varying torque that motivates it to angularly accelerate in a counterclockwise direction.
e.) None of the above.

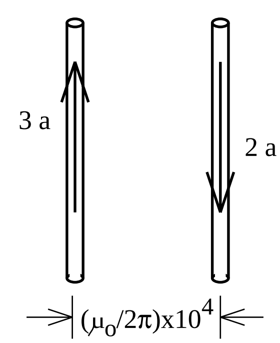


23.) Assume the inductor has no internal resistor-like resistance associated with it. If the frequency is doubled in this circuit:
a.) The resistive nature of the inductor will double, but the current will not halve.
b.) The resistive nature of the inductor will halve and the current will double.
c.) The resistive nature of the inductor will double and the current will double.
d.) The resistive nature of the inductor will halve and the current will halve.
e.) None of the above.



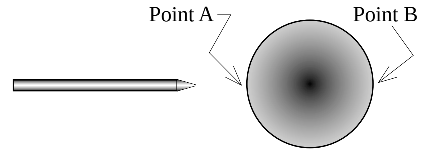
24.) Two identical triangles are being pulled out of a bounded B-field. At a given instant, each is half in, half out. In both cases, an external force magnitude F_o is being exerted on the triangles as shown.
a.) The accelerations of both will be the same, and the directions of the induced currents in both will be counterclockwise.
b.) The acceleration of A will be greater than the acceleration of C, and identical induced currents will exist in both circuits in the clockwise direction.
c.) The acceleration of A will be less than the acceleration of C, and identical induced currents will exist in both circuits in the clockwise direction.
d.) The acceleration of A will be greater than the acceleration of C, and identical induced currents will exist in both circuits in the counterclockwise direction.
e.) The acceleration of A will be less than the acceleration of C, and identical induced currents will exist in both circuits in the counterclockwise direction.
f.) None of the above.

25.) A parallel plate capacitor is charged completely, then isolated. The plate's area is then doubled, and the distance between its plates halved. Once all of the changes are made:
a.) The voltage across the plates will quadruple.
b.) The capacitance of the capacitor will quarter.
c.) The capacitance of the capacitor will halve.
d.) None of the above.



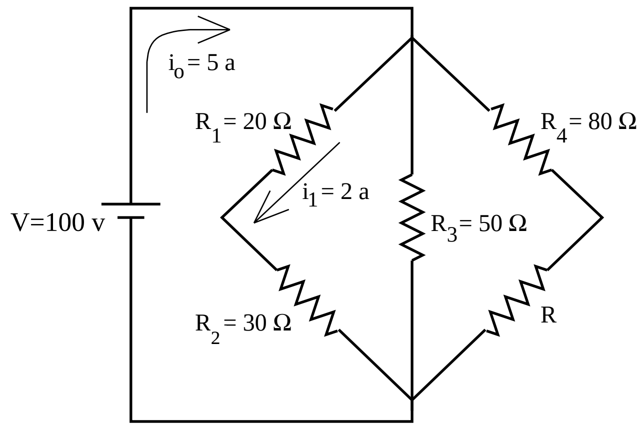
26.) The 3 amp wire in the sketch feels a force due to the presence of the 2 amp wire. The direction of that force will be:
a.) Into the page.
b.) Out of the page.
c.) To the right.
d.) To the left.
e.) None of the above.

27.) Positive charge is uniformly distributed throughout a pointed rod made of insulating material. The rod is brought in close to an electrically neutral conducting ball as shown. Both Point A and Point B are very close to the ball.

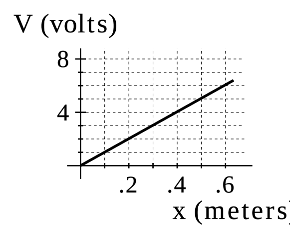


a.) The net electric field at Point A will be to the right, and the electric field at Point B will be to the left.
b.) The net electric field at Point A will be to the left, and the electric field at Point B will be to the left.
c.) The net electric field at Point A will be to the right, and the electric field at Point B will be to the right.
d.) The net electric field at Point A will be to the left, and the electric field at Point B will be to the right.

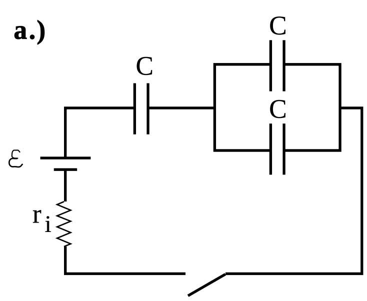
28.) Given the information shown in the circuit, determine R.
a.) 20 Ω.
b.) 40 Ω.
c.) 80 Ω.
d.) None of the above.

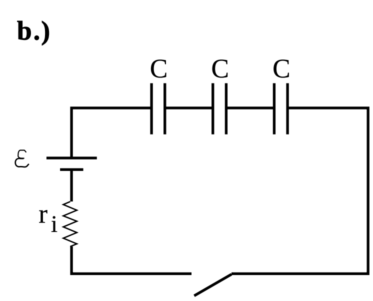


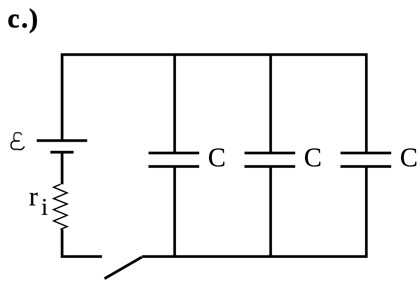
29.) An electrical potential field along the x-axis is defined by the graph shown. The electric field at x = .2 meters is:
a.) (10) i newtons/coulomb.
b.) (-10) i newtons/coulomb.
c.) (-2) i newtons/coulomb.
d.) (-.4) i newtons/coulomb.
e.) There is not enough information to tell.

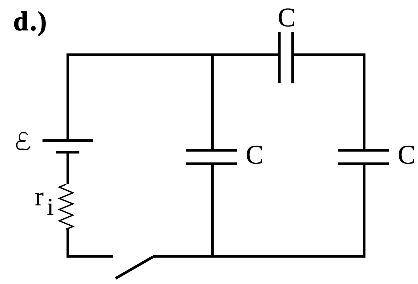


30.) In the circuit below, each of the capacitors characterized by C is the same size and initially uncharged. The power supply's EMF is $\mathcal{E}$ while its very small internal resistance is r_i. At t = 0, all of the switches are closed. Which circuit will draw the most initial current from the battery?



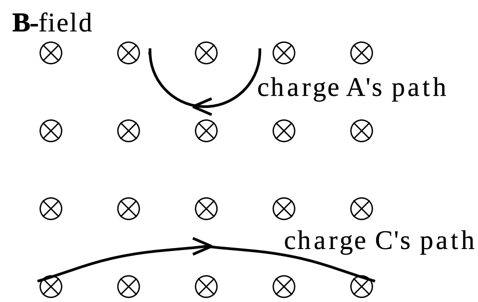






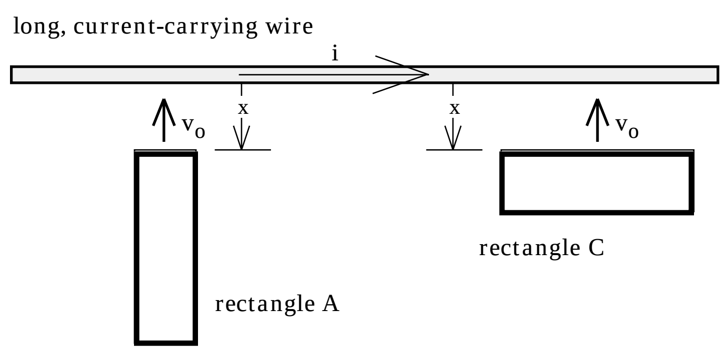
a.) Circuit a.
b.) Circuit b.
c.) Circuit c.
d.) Circuit d.
e.) There is more than one circuit that will draw the maximum current.

31.) Two charges of equal mass move in the plane of the paper with the same kinetic energy. As they pass through a magnetic field, they are observed. A sketch of the situation is shown to the right. From observation, it can be deduced that:



a.) Charge C is negative, charge A is negative, and charge C is larger in magnitude than charge A.
b.) Charge C is negative, charge A is positive, and charge C is larger in magnitude than charge A.
c.) Charge C is positive, charge A is negative, and charge C is smaller in magnitude than charge A.
d.) Charge C is positive, charge A is positive, and charge C is smaller in magnitude than charge A.
e.) None of the above.

32.) Two identical rectangular loops are both found a distance x units from a long, current-carrying wire. Each rectangle is forced to approach the current-carrying wire with the same constant velocity (see sketch and ignore gravity).



a.) The direction of the induced current in both is clockwise, and the force required to move rectangle A at a given constant velocity is greater than the force required to move rectangle C at that same velocity.
b.) The direction of the induced current in both is counterclockwise, and the force required to move rectangle A at a constant velocity is greater than the force required to move rectangle C at that same velocity.
c.) The direction of the induced current in both is clockwise, and the force required to move rectangle A at a constant velocity is less than the force required to move rectangle C at that same velocity.
d.) The direction of the induced current in both is counterclockwise, and the force required to move rectangle A at a constant velocity is less than the force required to move rectangle C at that same velocity.

e.) There is no need for extra force to push the coils toward the wire as there is no gravity in the problem.

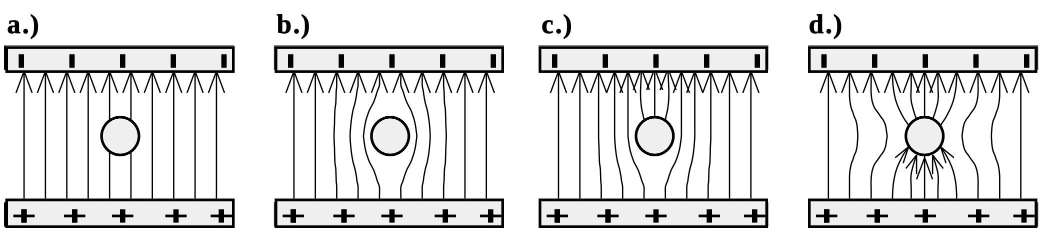
33.) A .5 kg mass has a 10 coulomb charge on it. It is placed at Point A in a constant electric field and released from rest, freely accelerating to Point B. The electrical potential of B is 40 volts. The mass's velocity is calculated and determined to be equal to v_1. If the charge had accelerated twice the distance between A and B:

a.) The final velocity would have doubled to $2v_1$.
b.) The final velocity would have quadrupled to $4v_1$.
c.) The final velocity would have halved to $v_1/2$.
d.) None of the above.

34.) A 100 μf capacitor is charged by a constant 2 mA current. How long will it take for the voltage across the capacitor to reach 40 volts?

a.) .5 seconds.
b.) .1 seconds.
c.) .02 seconds.
d.) None of the above.

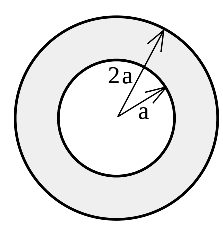
35.) An uncharged sphere made of a covalently bonded substance is placed between oppositely charged plates (see sketch). The electric field lines between the plates will look like:



e.) None of these.

36.) A variable power supply produces an AC voltage equal to 5 sin ($4\pi t$) volts.

a.) The peak to peak voltage for this source is 5 volts, and the RMS voltage is 3.5 volts.
b.) The peak to peak voltage for this source is 10 volts, and the RMS voltage is 3.5 volts.
c.) The peak to peak voltage for this source is 10 volts, and the RMS voltage is 7.07 volts.
d.) None of the above.



37.) Three identical hollow spheres each of inside radius a and outside radius 2a each have different charge distributions that place a given, common net amount of charge throughout their respective volumes. Denoting the spheres with the letters A, B, and C, the volume charge density on A is $k_1 r$, where k_1 is a constant; the volume charge density on B is k_2/r, where k_2 is a constant; and the volume charge density on C is $\frac{k_3 e^{-k_4 r}}{r^2}$, where k_3 and k_4 are constants. If E_A, E_B, and E_C denote the electric fields of A, B, and C, respectively, as evaluated at x = 2a (i.e., on the outer surface) then:

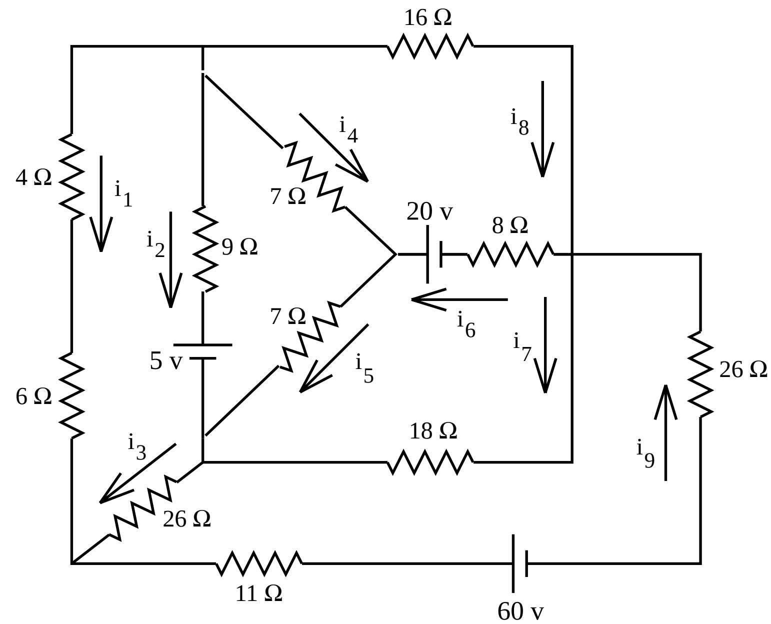
a.) $E_A > E_B > E_C$.

b.) $E_A < E_B < E_C$.

c.) $E_A > E_C > E_B$.

d.) $E_A = E_B = E_C$.

e.) None of the above.



38.) For the large circuit shown:

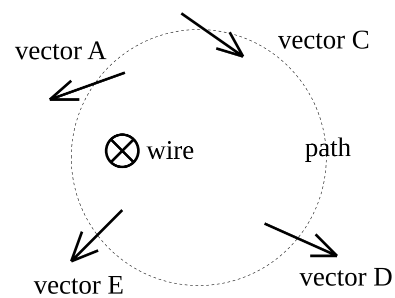
a.) $i_1 + i_2 + i_8 = 0$.

b.) $i_5 + i_6 = i_4$.

c.) $i_3 = i_2 + i_5 + i_7$.

d.) None of the above.

39.) A current-carrying wire is oriented so as to direct current into the page as shown in the sketch. An arbitrarily placed circle is positioned about the wire. Four vectors are defined on the circle. Which of the vectors accurately reflects the direction of the magnetic field as it exists where the vector crosses the circle?



a.) Vector A.

b.) Vectors A and E.

c.) Vector C.

d.) Vectors C and D.

e.) Vector D.

f.) None of the above.

40.) The magnitude of an electric field is defined by the expression $E = kr^2$, where k is a constant. The electrical potential function that goes with this electric field function is:

a.) $-kr^3/3$.

b.) $2kr$.

c.) $kr^2 \cos\theta$, where θ is the angle between the electric field vector and a line from the origin to the point in question.

d.) None of the above.