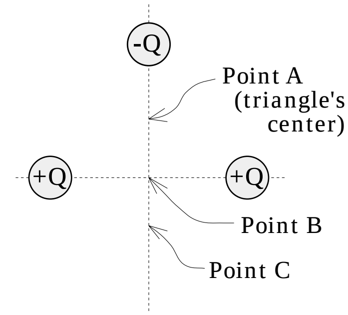
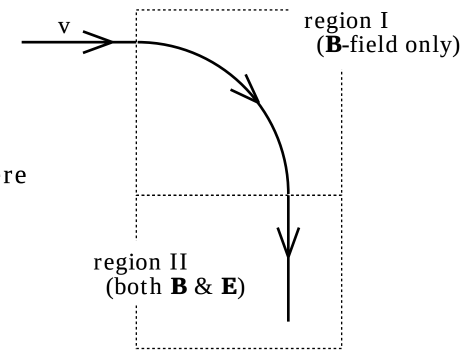
Multiple Choice -- TEST III



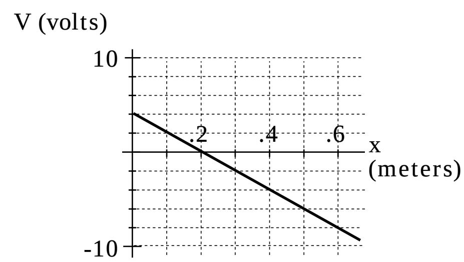
1.) Given the charge configuration shown to the right, where will the electric field be approximately zero?

a.) Point A.
b.) Point B.
c.) Point C.
d.) There is a point where E = 0, but it's not along the y-axis.



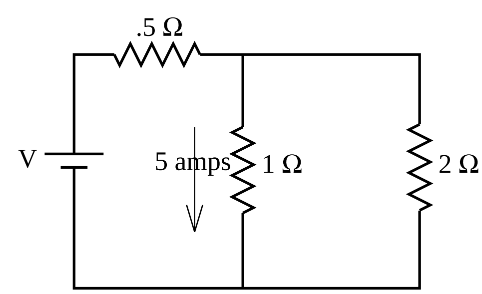
2.) A positive charge moves with known velocity v into region I in which an unknown B-field exists. It accelerates as shown in the sketch, then enters region II in which there exists not only B but also an unknown electric field E. With that:

a.) The magnitude of the magnetic field is mv/qR, where m is the mass of the charged particle and R is the radius of the charge's motion.
b.) The electric field is related to the magnetic field by E = B/v.
c.) The magnetic force in this situation is a conservative force.
d.) Both a and b.
e.) Both a and c.
f.) None of the above.



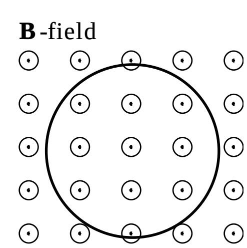
3.) An electrical potential field along the x-axis is defined by the graph shown. The electric field is:

a.) Constant and positive at x = .2 meters.
b.) Positive and non-linear.
c.) Negative and linear.
d.) Negative and non-linear.



4.) Consider the circuit shown. How much current is drawn from the battery?

a.) 15 amps.
b.) 7.5 amps.
c.) 3.3 amps.
d.) None of the above.

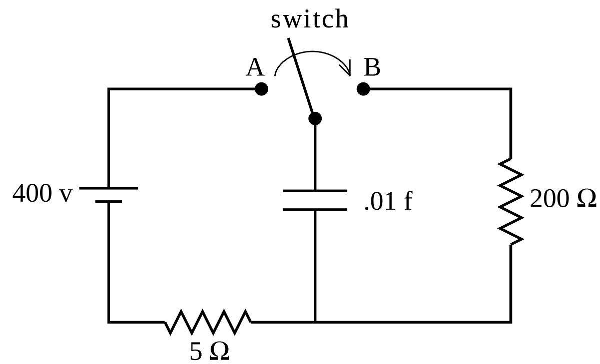


5.) A 50 turn coil whose face area is 2 square meters and whose resistance is R = 12 Ω faces a uniform B-field coming out of the page that doubles at a constant rate every 10 seconds. At t = 0, the magnetic field intensity is .25 teslas. The magnitude of the magnetic flux set up through the coil at t = 5 seconds will be:

a.) .75 teslas.
b.) .75 webers.

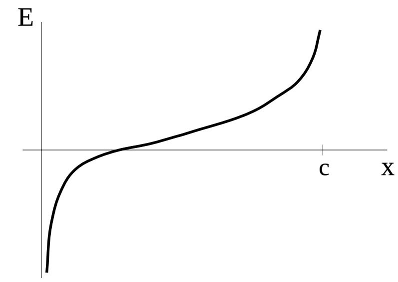
c.) 1.5 tesla·meters^2.
d.) None of the above.

6.) In the system shown, the switch has been set on contact A for a long time. At t = 0, the switch flips from contact A to contact B. How long will it take for the capacitor to dump approximately 90% of its charge across the resistor?



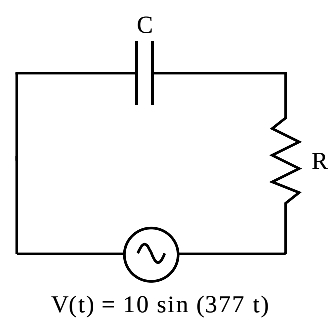
a.) (1/4) second.
b.) (1/2) second.
c.) 2 seconds.
d.) 4 seconds.

7.) Charge A is placed at the origin and charge B is placed a distance c units down the +x axis. A graph of the magnitude of the subsequent electric field E between the two is shown to the right.



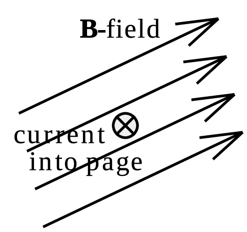
a.) Both charges are positive with charge A being larger in magnitude.
b.) Both charges are negative with charge A being larger in magnitude.
c.) Charge A is negative while charge B is positive, and charge B is larger in magnitude.
d.) Charge A is negative while charge B is positive, and charge B is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

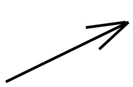
8.) The capacitance of the capacitor in the circuit is 10 nf and the resistance is R = 1000 Ω. If the frequency of the source is changed to 120 cycles/second:

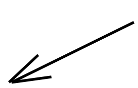


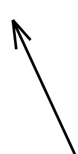
a.) The frequency of the circuit will go down and the impedance will go up.
b.) The frequency of the circuit will go down and the impedance will also go down.
c.) The frequency of the circuit will go up and the impedance will also go up.
d.) The frequency of the circuit will go up and the impedance will go down.

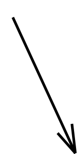
9.) A wire with current directed into the page sits in a magnetic field as shown. The direction of the force on the wire is best described by which selection?



a.) 

b.) 

c.) 

d.) 

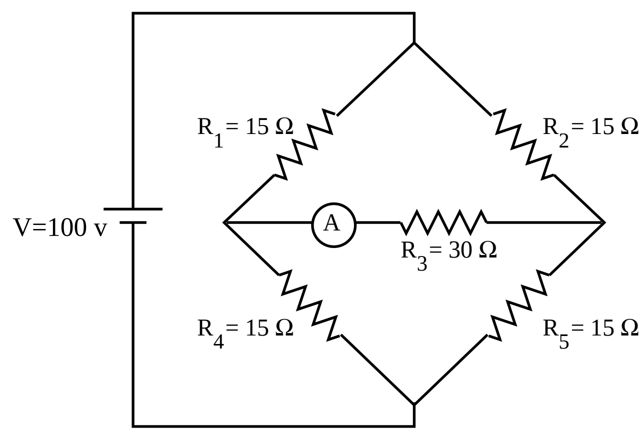
e.) None of these.

10.) A very long, charge-filled cylinder of radius a has a Gaussian surface (a cylinder) placed about it. The radius of the Gaussian surface is a (that is, the Gaussian surface is placed directly on top of the cylinder). For that situation, the net flux through the Gaussian surface is ϕ. The radius of the Gaussian cylinder is then doubled to 2r with everything else held constant. For this new situation, the net flux through the new Gaussian surface will be:

- a.) 2ϕ.
- b.) ϕ.
- c.) $\phi/2$.
- d.) None of the above.

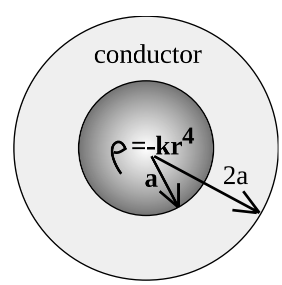
11.) The capacitance of a capacitor is 120 picofarads. That capacitance is the same as:

- a.) $1.2\text{x}10^{-10}$ farads.
- b.) $120\text{x}10^{-6}$ microfarads.
- c.) 120,000 nanofarads.
- d.) Both a and b.
- e.) Responses a, b, and c.
- f.) None of the above.

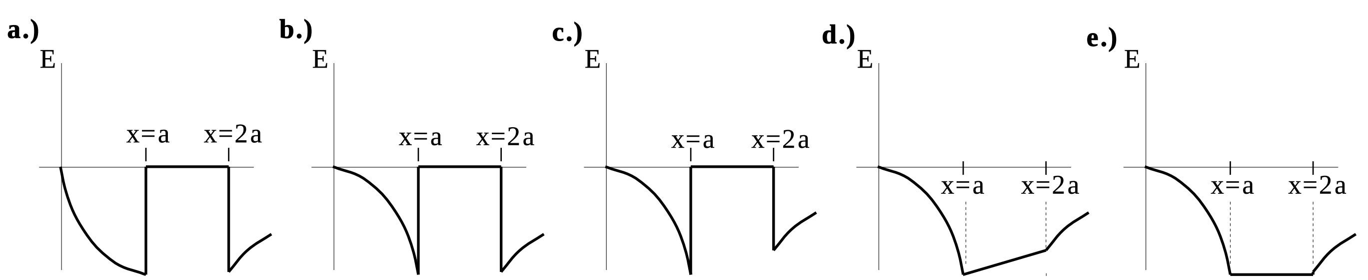


12.) In the circuit to the right, what will the ammeter read?

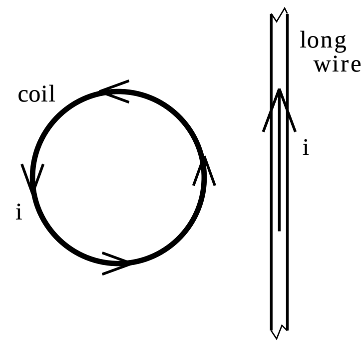
- a.) Zero amps.
- b.) 3.3 amps.
- c.) 10 amps.
- d.) None of the above.



13.) A solid sphere of radius a has a volume charge density of $-kr^4$ shot through it, where k is a constant equal to one with appropriate units. Surrounding the sphere is a conducting shell of outer radius 2a. A graph of the electrical potential field for this configuration looks like:



14.) A coil carrying current i is placed next to a long wire that also carries current i, as shown. Due to its interaction with the long wire's magnetic field:

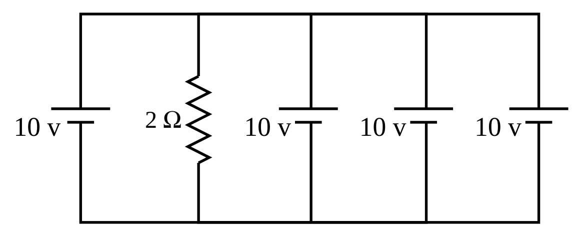


a.) A net force will be applied to the coil directed toward the right.
b.) A torque will be applied to the coil that motivates it to rotate about an axis parallel to the i direction and in such a way as to have the top of the coil come out of the page.
c.) A net force directed toward the left will be applied to the coil.
d.) None of the above.

15.) A parallel plate, 50 mf capacitor has $5x10^{-9}$ coulombs of charge on it. If the plates are .01 meters apart, and if there is a dielectric between the plates whose dielectric constant is 2, what is the electric field between the plates when the dielectric is removed? You can ignore edge effects.

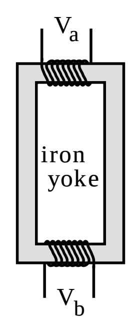
a.) $1x10^{-5}$ volts/meter.
b.) $2x10^{-5}$ volts/meter.
c.) $4x10^{-5}$ volts/meter.
d.) None of the above.

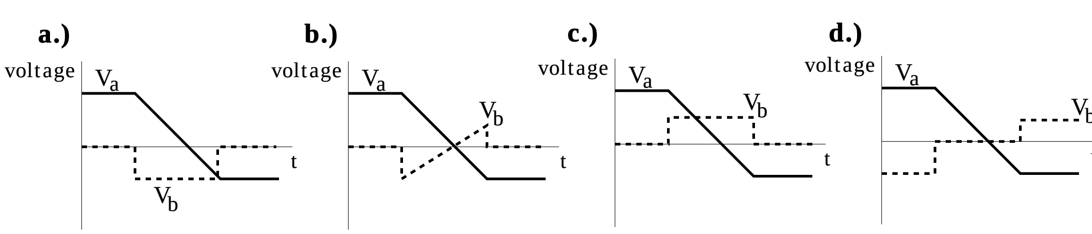
16.) Consider the circuit shown. If four more 10 volt batteries were added in parallel to the power supplies already there:



a.) The net power dissipated by the 2 Ω resistor will increase.
b.) The net power dissipated by the 2 Ω resistor will decrease.
c.) The net power dissipated by the 2 Ω resistor will stay the same.
d.) There is not enough information to tell what the power dissipated by the 2 Ω resistor will do.

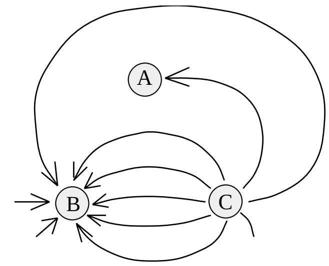
17.) An iron yoke has a primary and secondary coil wrapped around each end as shown to the right (the winds ratio is not to scale on the sketch). The voltage V_a across the primary terminal is graphed below along with possible secondary voltage functions (V_b's). Which V_b graph is consistent with the V_a graph?





e.) None of these.

18.) Three charges produced the anti-symmetric lines shown in the sketch.



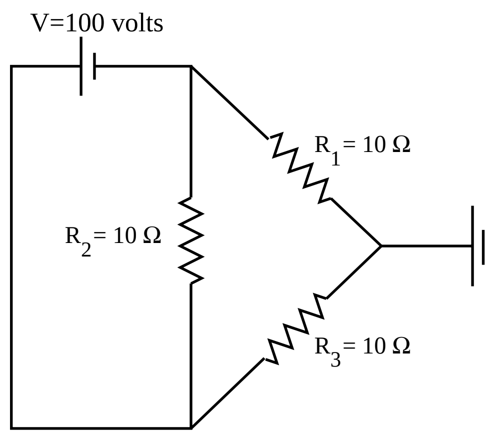
a.) Charge A is negative, charge B is positive, and charge C is negative. Additionally, the magnitude of charge A is smaller than the magnitude of charge B.

b.) Charge A is negative, charge B is negative, and charge C is positive. Additionally, the magnitude of charge A is smaller than the magnitude of charge B.

c.) Charge A is negative, charge B is negative, and charge C is positive. Additionally, the magnitude of charge A is bigger than the magnitude of charge B.

d.) None of the above.

19.) Three equal resistors (labeled for discussion purposes) are connected in the grounded circuit as shown.



a.) The current through R_2 will be the same as the current through both R_1 and R_3.

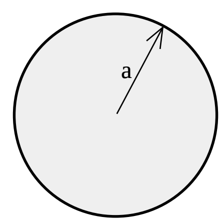
b.) The current through R_1 will be zero.

c.) The equivalent resistance of this circuit is 5 Ω.

d.) Both b and c.

e.) None of the above.

20.) A solid sphere of radius a has a volume charge density shot through it of $k_1 r$, where $k_1 = 10^{-10}$ with appropriate units, a = 1 meter, and the constant $\frac{1}{4\pi\varepsilon_o}$ can be approximated as 10^{10} $coul^2/(nt \cdot m^2)$. The electric field at x = a/2 will be:



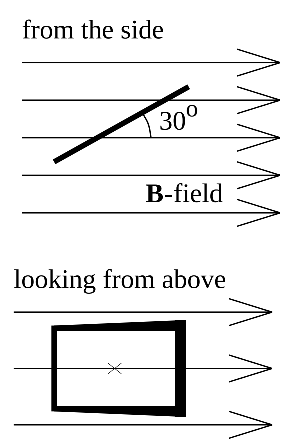
a.) (1/16) nt/coul.

b.) (1/4) nt/coul.

c.) $(1/16)\times 10^{-20}$ nt/coul.

d.) None of the above.

21.) A rectangular loop whose area is 1 square meter is situated in a magnetic field as shown in the sketch. If the constant B-field's magnitude is .2 tesla, the magnetic flux through the coil will be:



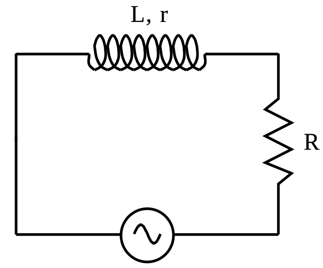
a.) .2 webers, and there will be an induced current set up in the coil due to the presence of the magnetic field.

b.) .172 webers, and there will not be an induced current set up in the coil due to the presence of the magnetic field.

c.) .1 webers, and there will not be an induced current set up in the coil due to the presence of the magnetic field.

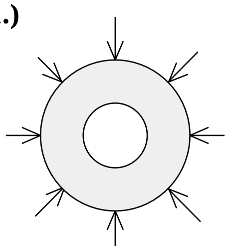
d.) None of the above.

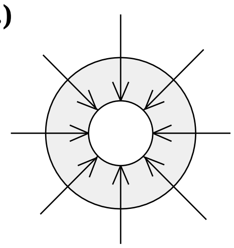
22.) The inductance of the inductor in the circuit shown is 10 mH and its resistor-like resistance is 15 Ω. The load resistor is R = 1000 Ω. If the frequency of the source is changed to 120 cycles/second:

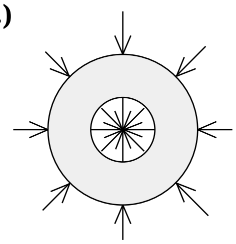


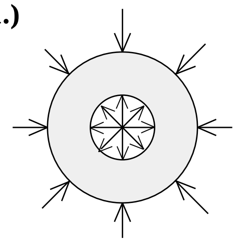
a.) The inductive reactance will go down and the impedance will go up.
b.) The inductive reactance will go down and the impedance will go down.
c.) The inductive reactance will go up and the impedance will go up.
d.) The inductive reactance will go up and the impedance will go down.

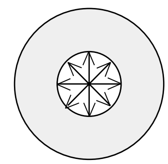
23.) If you place a charge -Q on a hollow conducting sphere, then levitate an equal charge +Q at the hollow's center, the electric field lines for the situation will look like:

a.)


b.)


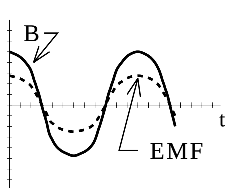
c.)


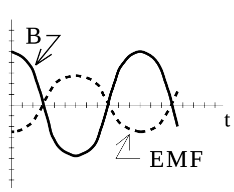
d.)


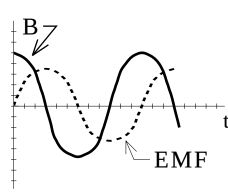
e.)


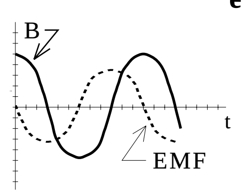
24.) Which statement is true?
a.) An electric field has the units of volts/coulomb.
b.) An electrical potential vector has the units of volts.
c.) Electrical potential energy has the units of volts.
d.) None of the above.

25.) A coil is placed in a changing magnetic field. A graph of the B-field is shown on each of the grids below. Due to the changing B-field, an induced EMF is generated in the coil. Which graph depicts the appropriate EMF function, given the B-field function?

a.)


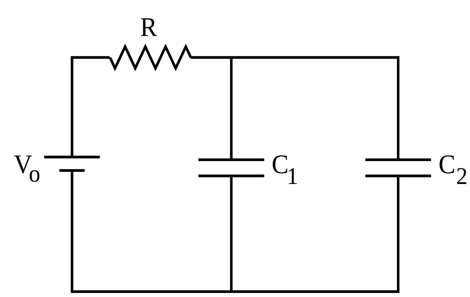
b.)


c.)


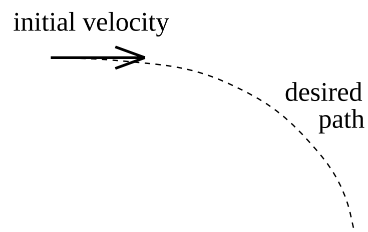
d.)


e.) None of these.

26.) Enough time has passed for the capacitors in the circuit to fully charge. A dielectric (dielectric constant equal to 2) is slipped between the plates effectively doubling the capacitance of C_1. As a consequence:

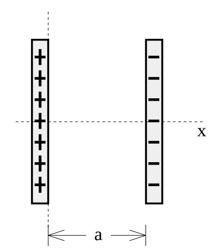


a.) The voltage across C_1 just after the change will halve.
b.) The capacitor C_1 charges and the power provided by the power supply during that charge-up is $.5CV^2$.
c.) The circuit's time constant decreases.
d.) Both b and c.
e.) None of the above.

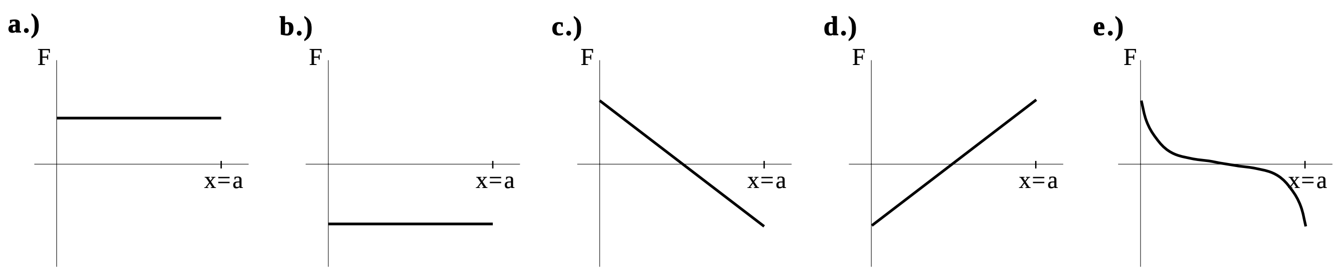


27.) A Star Fleet wannabe tries to accurately simulate the flight of an arrow of mass m and initial velocity v close to the earth's surface (i.e., in a gravitational setting). To do this, she eliminates gravity, puts a charge q on the arrow, and fires the arrow with initial velocity v through a time-varying magnetic field. The path to be followed is shown in the sketch.

a.) The direction of the B-field must be downward and its magnitude must be mg/qv, where v is the velocity of the charged arrow at any arbitrary point in time.
b.) The direction of the B-field must be into the page and its magnitude must be mg/qv, where v is the velocity of the charged arrow at any arbitrary point in time.
c.) The direction of the B-field must be out of the page and its magnitude must be mg/qv, where v is the velocity of the charged arrow at any arbitrary point in time.
d.) None of the above.



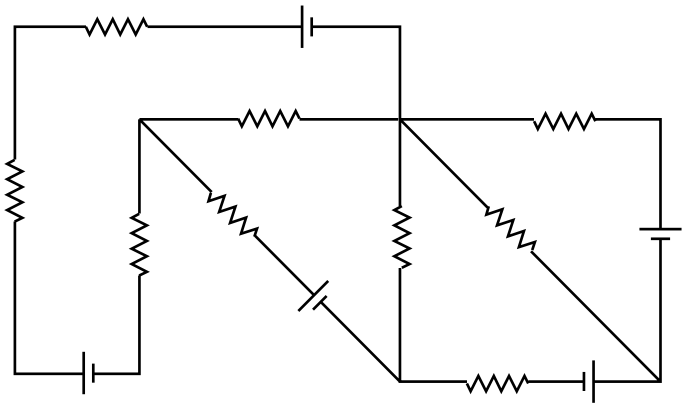
28.) Oppositely charged parallel plates are set up and the force on an electron placed at various points between the plates is recorded. The graph of the Force vs. Position function for the region between the plates looks like:



29.) A variable power supply produces an AC voltage equal to 5sin $(4\pi t)$ volts. The power supply is placed in series with a 100 Ω resistor and an AC ammeter. The ammeter will read:

a.) Zero amps because the charge carriers in an AC circuit don't go anywhere, they just jiggle back and forth due to the alternating voltage and its associated alternating electric field.
b.) .05 amps.
c.) .035 amps.
d.) .07 amps.

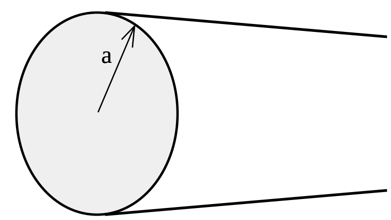
30.) For the circuit shown to the right:



a.) There are 3 nodes, 6 branches, and 11 loops in this circuit.
b.) There are 4 nodes, 7 branches, and 9 loops in this circuit.
c.) There are 4 nodes, 8 branches, and 11 loops in this circuit.
d.) None of the above.

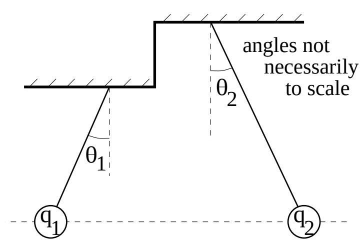
31.) A 2 kg mass has a 10 coulomb charge on it. It is placed at Point A in a constant electric field and released from rest, freely accelerating to Point B. The electrical potential of B is 40 volts. The mass's velocity at B is 4 m/s. Assuming the charge continues to accelerate on to a third point (call it Point C) where the electrical potential is 80 volts, what is the charge's velocity at that point?
a.) Approximately 19.5 m/s.
b.) Approximately -19.5 m/s.
c.) There is not enough information to determine the answer to this problem.
d.) This problem is impossible to answer with a number because the charge never reaches a point where the electrical potential equals 80 volts.

32.) A solid cylinder of radius a has a volume charge density shot through it of $k_1 r$, where $k_1 = 10^{-10}$ with appropriate units, a = 1 meter, and the constant ε_o is approximated as 10^{-11} coul^2/(nt·m^2). The electric field at x = a/2 will be:



a.) .20 nt/coul.
b.) .65 nt/coul.
c.) .83 nt/coul.
d.) None of the above.

33.) A charge q_1 is placed on a mass m that is suspended from a string. A second charge q_2 is placed on an identical mass m suspended on a second string. The two strings are attached to the ceiling as shown in the sketch.



a.) $\theta_1 = \theta_2$.
b.) $\theta_1 < \theta_2$.
c.) $\theta_1 > \theta_2$.
d.) The relationship between the angles can't be determined with the information given.

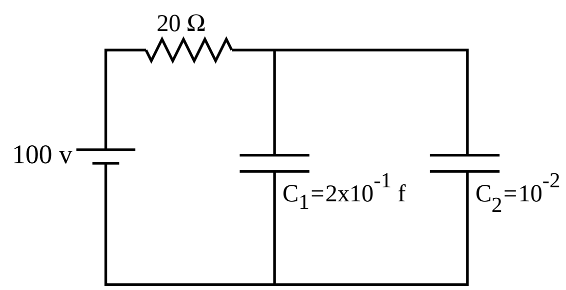
34.) A capacitor and inductor are placed in series with a resistor and an AC power supply. The frequency of the power supply is tuned to the resonant frequency for the circuit. The frequency is then quadrupled.

a.) The capacitive reactance will increase, the inductive reactance will decrease, and between the two the larger change will occur to the inductive reactance.
b.) The capacitive reactance will increase, the inductive reactance will decrease, and between the two the larger change will occur to the capacitive reactance.
c.) The capacitive reactance will decrease, the inductive reactance will increase, and between the two the larger change will occur to the inductive reactance.
d.) The capacitive reactance will decrease, the inductive reactance will increase, and between the two the larger change will occur to the capacitive reactance.

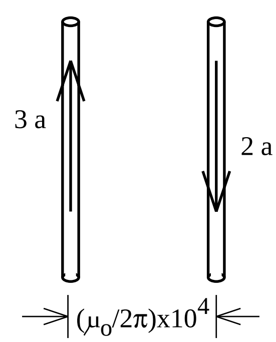
35.) The average power delivered to a flashbulb is 500 watts when a 2000 volt source fully charges the system's capacitor. If the flash lasts .08 seconds, the capacitance of the capacitor must be somewhere in the vicinity of:
a.) 10^{-9} farads.
b.) 10^{-6} farads.
c.) 10^{-3} farads.
d.) None of the above.

36.) The inductance of a coil is .5 mH. The current change that would be required to induce a 3 volt potential across the coil's leads is:
a.) 1.5 amps/second.
b.) .015 amps/second.
c.) 6 amps/second.
d.) None of the above.

37.) At the instant shown, the current through the 20 Ω resistor is 2 amps. The charge on C_2 is:
a.) .6 coulombs.
b.) 1.2 coulombs.
c.) 2.4 coulombs.
d.) None of the above.



38.) The force per unit length a 3 amp wire (call this wire 1) feels due to the presence of a 2 amp wire (call this wire 2) will:
a.) Equal 3 newtons per meter and will be 3/2 the force the 2 amp wire feels due to the presence of the 3 amp wire.
b.) Equal 6 newtons per meter and will be 2/3 the force the 2 amp wire feels due to the presence of the 3 amp wire.
c.) Equal 9 newtons per meter and will be the same as the force the 2 amp wire feels due to the presence of the 3 amp wire.
d.) None of the above.



39.) For the circuit shown:

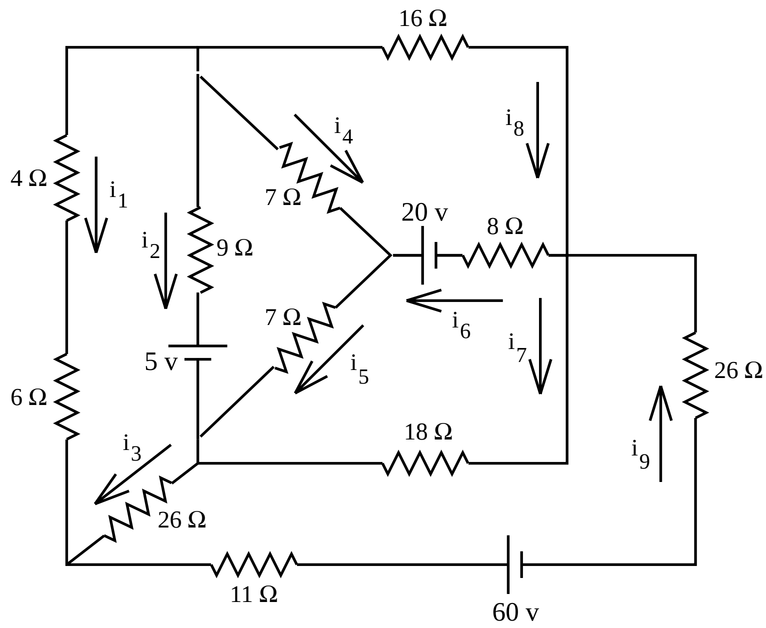
a.) $-37i_9 - 18i_7 - 26i_3 = 60$.

b.) $16i_8 - 7i_4 + 8i_6 = -20$.

c.) $7i_4 - 9i_2 + 7i_5 = 5$.

d.) There are at least two correct loop equations above.

e.) None of the above.



40.) In a 10 second period, a -2 coulomb charge is made to move with constant velocity from the top to the bottom of the electrical potential field shown.

a.) The work the field does is positive, and the magnitude of the electric field increases as one proceeds upward.

b.) The work the field does is negative, and the magnitude of the electric field increases as one proceeds downward.

c.) The work the field does is positive, and the magnitude of the electric field increases as one proceeds upward.

d.) None of the above.