Q1. A string, of mass 5.0 g and length 75 cm, is fixed at both ends and has resonant frequencies of 72 Hz and 86 Hz with no intermediate resonant frequencies. What is the tension in the string?

A) 2.9 N
B) 21 N
C) 0.21 N
D) 2.2 N
E) 0.16 N

Q2. A point source of sound has an average power output of 1.75 μW. What is the sound level at a distance of 5.00 m from the source?

A) 37.5 dB
B) 44.4 dB
C) 62.4 dB
D) 56.8 dB
E) 91.7 dB

Q3. A 2.5-kg piece of aluminum is heated to 95 ^{o}C and then dropped into 7.4 kg of water initially at 5.0 ^{o}C. What is the final equilibrium temperature? [c_w = 4190 J/kg.K, c_{Al} = 900 J/kg.K]

A) + 11 ^{o}C
B) – 69 ^{o}C
C) – 23 ^{o}C
D) + 47 ^{o}C
E) + 97 ^{o}C

Q4. The temperature of 1.50 moles of an ideal monatomic gas is raised by 24.5 K in an adiabatic process. How much work is done in the process?

A) 458 J on the gas
B) 458 J by the gas
C) 916 J on the gas
D) 753 J on the gas
E) 753 J by the gas

Q5. How much energy must be transferred as heat for an isothermal expansion of an ideal gas at 132 ^{o}C if the entropy of the gas increases by 48.0 J/K?

A) 19.4 kJ
B) 6.34 kJ
C) 2.75 kJ
D) 8.44 kJ
E) 11.8 kJ

Q6. Specify the WRONG statements:
1. In solid metal conductors electrons as well as positive ions can move.
2. Charge is quantized.

3. Charge is conserved
4. Coulomb's law gives the force between static point charges.
5. The principle of superposition means that the force between two static particles is not affected by the presence of other particles.

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

Q7. A 1.0 nC charged particle is located at the origin. Determine the electric field at point x = 1.0 m and y = 1.0 m..

A) 3.2 (i + j) N/C
B) 4.5 (i + j) N/C
C) 4.5 (i) N/C
D) 3.2 (j) N/C
E) 4.5 (k) N/C

Q8. A conductor has a net charge of -50 nC. Inside the conductor is a cavity in which there is +100 nC point charge. What is the charge on the outer surface of the conductor?

A) +50 nC
B) -50 nC
C) +100 nC
D) -100 nC
E) 0

Q9. The electric field in a region of space is E_x = 5000 x V/m, where x is in meters. Find an expression for the potential V at point x. As a reference, let V = 0 at the origin.

A) $-2500x^2$ Volts
B) $+ 2500x^2$ Volts
C) -2500x Volts
D) +2500x Volts
E) -5000 Volts

Q10. A 5.0 pF parallel plate capacitor has a potential difference of 25 V across its plates. The plate area is 40 cm^2. Find the energy density between the plates.

A) 55 $\mu J/m^3$
B) 1.6 $\mu J/m^3$
C) 3.2 $\mu J/m^3$
D) 100 $\mu J/m^3$
E) 110 $\mu J/m^3$

Q11. The resistivity of copper at 20 ^oC is 1.7×10^{-8} Ω.m. A copper wire has a length of 5.0 m and a cross sectional area of 7.9×10^{-7} m^2. What is the resistance of the wire at 100 ^oC.

Assume that the area and length of the wire do not change. The temperature coefficient of resistivity for copper is $\alpha = 4.1 \times 10^{-3}$ $(^{o}C)^{-1}$.

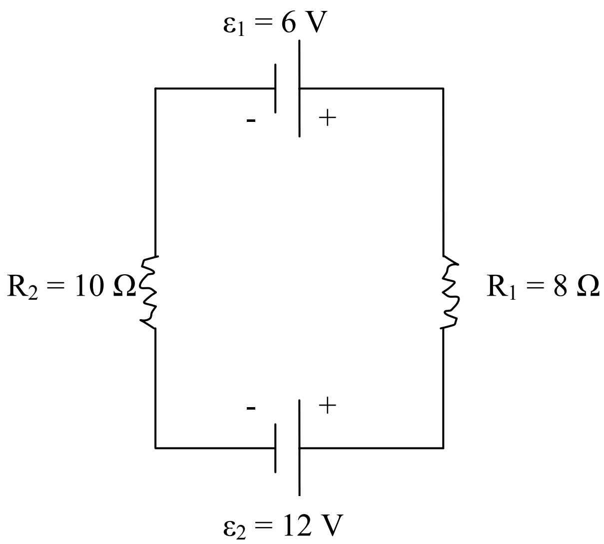
A) 0.14 Ω
B) 0.35 Ω
C) 1.7 Ω
D) 3.8 Ω
E) 0.87 Ω

Q12. A conducting wire has a length of 3.0 m and a resistance of 0.35 Ω. When a potential difference is applied to the ends of the wire, a current of 1.8 A is produced in it. What is the magnitude of the electric field inside the wire?

A) 0.21 V/m
B) 1.7 V/m
C) 1.9 V/m
D) 4.8 V/m
E) 0.74 V/m

Q13. A single loop circuit contains two external resistors and two emf sources as shown in the figure. Assume the emf sources are ideal, what is the power dissipation across resistor R_1.

Fig#



A) 0.9 W
B) 0.7 W
C) 18 W
D) 0.5 W
E) 8.0 W

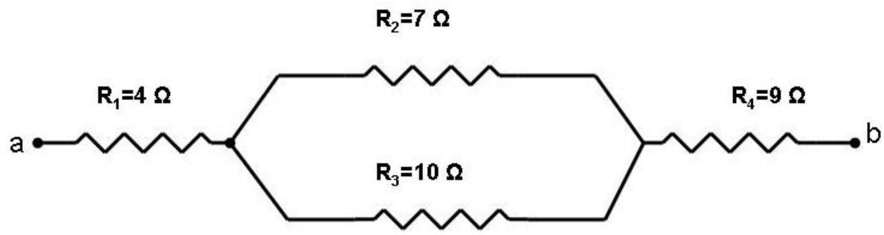
Q14. A capacitor of capacitance 5.0×10^{-6} F is discharging through a 4.0 M Ω resistor. At what time will the energy stored in the capacitor be half of its initial value?

A) 7 s

B) 9 s
C) 5 s
D) 8 s
E) 4 s

Q15. Four resistors are connected as shown in the figure. What is the current through R_1, when a potential difference of 30.0 Volts is applied between points a and b?

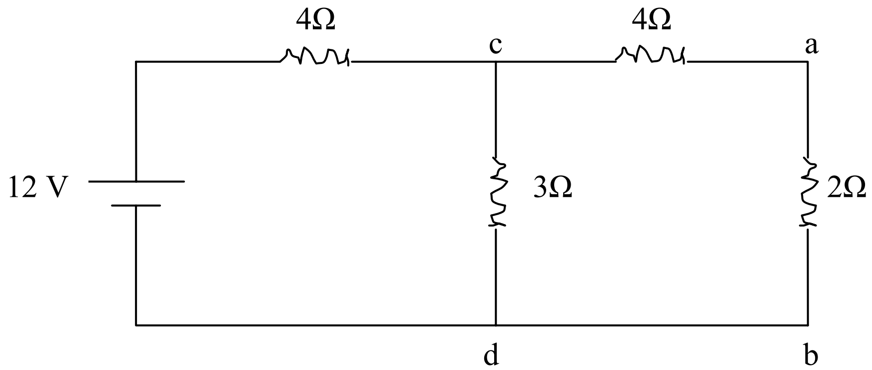
Fig#



A) 1.75 A
B) 1.50 A
C) 1.65 A
D) 2.75 A
E) 2.00 A

Q16. If $V_a - V_b = 3.2$ V, what is $V_d - V_c$?

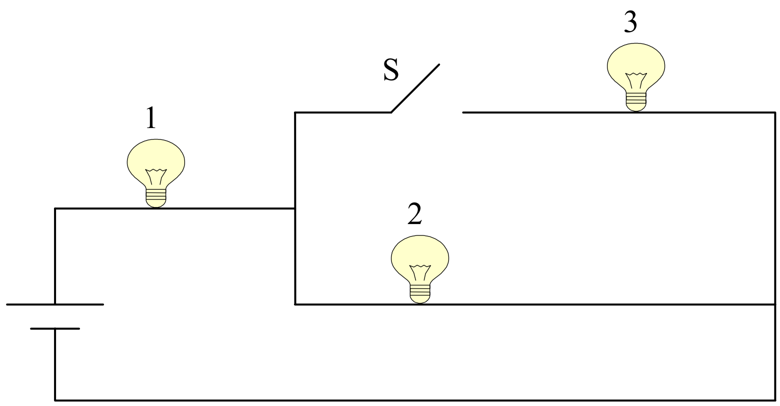
Fig#



A) -9.6 V
B) +9.6 V
C) +3.6 V
D) -3.6 V
E) -12 V

Q17. The figure below shows 3 identical light bulbs connected to a battery. What happens to the power of light bulb 1 when the switch S is closed?

Fig#



A) The power increases.
B) The power will increase momentarily then returns to its initial value.
C) The power will decrease momentarily then returns to its previous value.
D) The power remains the same.
E) The power decreases.

Q18. Which of the following is the CORRECT statement?

A) The magnetic force on a charged particle could never be in the direction of its velocity.
B) The magnetic force does work on a moving charge.
C) The kinetic energy of a charged particle increases in a constant magnetic field.
D) The acceleration of a charged particle under constant magnetic field is zero.
E) The magnetic force does exist on a static charge.

Q19. A loop of wire carrying a current of 3.0 A is in the shape of a right triangle with two equal sides, each 16 cm long. A 0.8T uniform magnetic field is parallel to the hypotenuse. The total magnetic force on the two equal sides has a magnitude of:

A) 0
B) 0.21N
C) 0.30N
D) 0.41N
E) 0.51N

Q20. A potential difference of 600 V is applied to accelerate an electron from rest. This accelerated electron enters a uniform magnetic field and completes one revolution in 9 nano seconds. Determine the radius of the electron orbit?

A) 0.021 m
B) 0.13 m
C) 0.061 m
D) 0.032 m
E) 0.50 m

Q21. An electron with a velocity of $v = (4.0\times10^4\ i + 3.0\times10^6\ j)$ m/s enters a region of magnetic field $B = (0.40\ i)$ T. The magnetic force on the electron is:

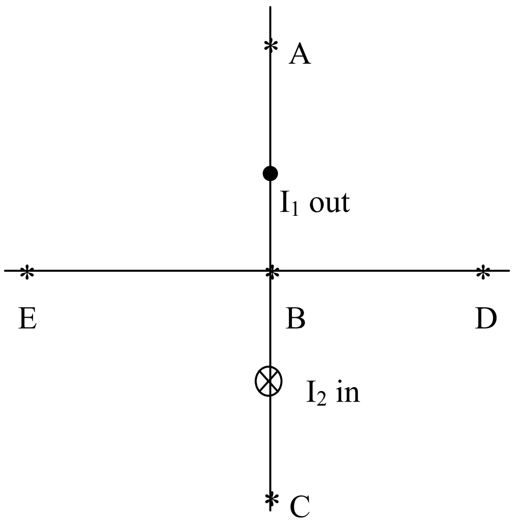
A) 1.9×10^{-13} k
B) - 1.9×10^{-13} k
C) 2.6×10^{-13} j
D) 3.2×10^{-13} k
E) 2.6×10^{-13} i

Q22. A 300 turn square loop, having a side length of 6 cm, carries a current of 15 A. The loop is placed in an external magnetic field of magnitude 3.0 T. Determine the magnitude of the maximum torque exerted on the loop.

A) 49 N.m
B) 810 N.m
C) 0.16 N.m
D) 0.040 N.m
E) 0

Q23. Two long straight, parallel wires are 3.0 cm apart. They carry currents $I_1 = 3.0$ A and $I_2 = 5.0$ A in opposite directions, as shown in the figure. At what point, beside infinity, could the magnetic field be zero?

Fig#



A) A
B) B
C) C
D) D
E) E

Q24. A cylindrical wire of radius R carries current I uniformly distributed across its cross-section. Find the magnetic field inside the wire at r < R from the axis.

A) $\mu_o \dfrac{Ir}{2\pi R^2}$

B) $\mu_o \dfrac{I}{2\pi R}$

C) $\mu_o \dfrac{I}{2\pi r}$

D) $\mu_o \dfrac{IR^2}{2\pi r^2}$

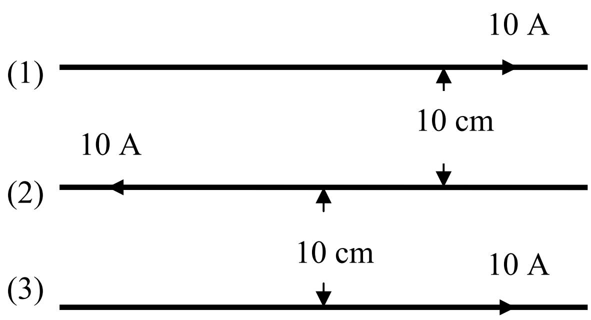
E) $\mu_o \dfrac{I}{4\pi r}$

Q25. A magnetic field of 0.10 T is generated near the center of a 10 cm long solenoid. How many turns are needed if the current in the wire is 10 A?

A) 796
B) 555
C) 666
D) 461
E) 100

Q26. What is the net force per unit length on the upper wire (#1) in the figure?

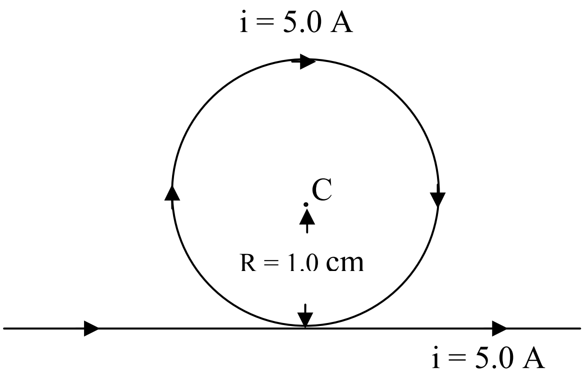
Fig#



A) 1.0×10^{-4} N/m upward
B) 1.0×10^{-4} N/m downward
C) 2.0×10^{-4} N/m upward
D) 2.0×10^{-4} N/m downward
E) Zero

Q27. What is the magnetic field at the center of the loop in the figure.

Fig#



A) 2.1×10^{-4} T into the page
B) 2.1×10^{-4} T out of the page
C) 4.1×10^{-4} T into the page
D) 4.1×10^{-4} T out of the page
E) 1.0×10^{-4} T into the page

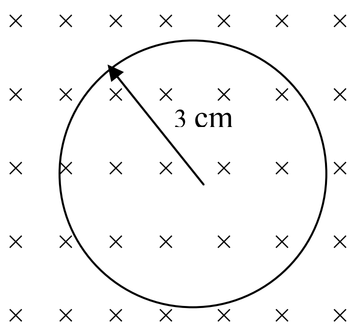
Q28. The figure shows a conducting loop that is placed perpendicular to an external magnetic field that points into the page. Which of the following changes will induce a counter-clockwise current?

Fig#

A) Increasing the magnitude of the magnetic field.
B) Decreasing the magnitude of the magnetic field.
C) Decreasing the area of the loop.
D) Sliding the loop out of the field.
E) Rotating the loop around an axis through its center perpendicular to the page.

Q29. In the figure the magnetic field decreases from 1.0 T to 0.40 T in 1.2 s. A 3.0 cm radius conducting loop with a resistance of 0.010 Ω is perpendicular to **B**. What are the size and the direction of the current induced in the loop?

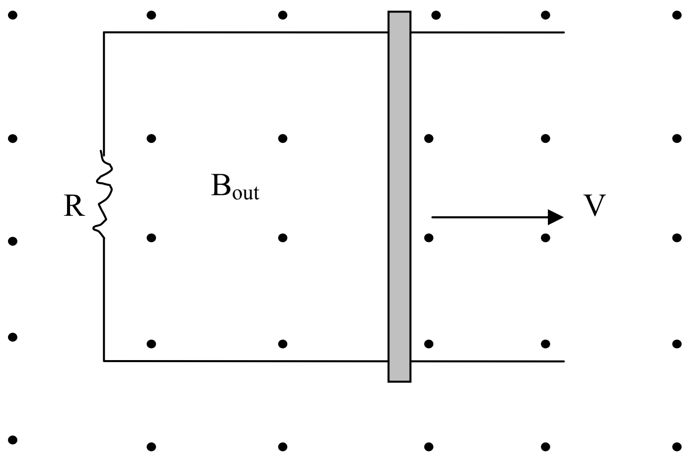
Fig#



A) 140 mA and current is clockwise.
B) 220 mA and current is anticlockwise.
C) 110 mA and current is clockwise.
D) 320 mA and current is anticlockwise.
E) 94 mA and current is clockwise.

Q30. A metal rod of length L = 5.0 cm moves at constant speed v on rails of negligible resistance that terminate in a resistance R = 0.2 Ω, as shown in the figure. A uniform and constant magnetic field B = 0.25 T is normal to the plane of the rails. The induced current is I = 2.0 A. Find the speed v.

Fig#



A) 32 m/s
B) 35 m/s
C) 45 m/s
D) 12 m/s
E) 75 m/s