UNIVERSITY OF BAHRAIN

DEPARTMENT OF PHYSICS

Question	Marks
MCQ	(/48)
Problem 1	(/13)
Problem 2	(/13)
Problem 3	(/13)
Problem 4	(/13)
Total	(/100)
Total	(/40)

Use BLOCK LETTERS:

Full Name :______________________________

Student No.:_____________________________

Section :______________________________

Course Title: General Physics II

Course No.: PHYCS 102

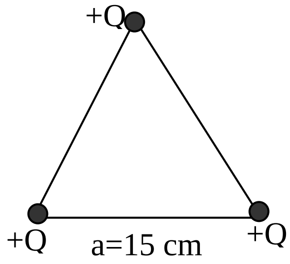
Student Signature:________________________

Date: 17-6-2003

$e = 1.6\times10^{-19}$C,	$m_e=9.11\times10^{-31}$Kg,	$m_p=1.67\times10^{-27}$Kg
$k=9\times10^{9}$ Nm^2/C^2,	$\varepsilon_0=8.85\times10^{-12}$ C^2/Nm^2,	$\mu_0=4\pi\times10^{-7}$ T.m/A

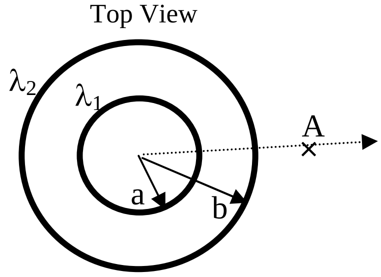
Part I: 12 MCQ (4 marks each)

Q1- Three equal positive point charges Q= (6.0, 9.0, 12.0, 15.0) nC are located at the corners of an equilateral triangle of side a=15.0 cm, as shown in the figure. The magnitude of the net electric force (in μN) on each charge is:



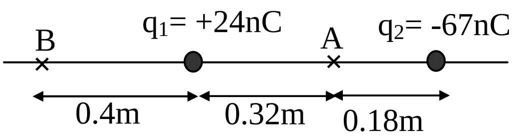
(A) 24.9 (B) 56.1 (C) 99.8 (D) 155.9

Q2- The cross section of a long coaxial cable is shown in the figure. The linear charge density on the inner cylinder of radius a= 30 mm is λ_1= -80.0 nC/m and on the outer cylinder of radius b=51 mm is λ_2= -30.0 nC/m. The magnitude of the electric field (in kN/C) at point A, which is(120,100,80,60) mm from the axis is:



(A) 16.5 (B) 19.8 (C) 24.7 (D) 33.0

Q3- Two point charges, q_1= +24.0 nC and q_2= -67.0 nC, are placed as shown in the figure. A third charge of (2.0, 3.0, 4.0,5.0) nC is placed at point A. The magnitude of the work (in μ J) needed to move the third charge from point A to point B is:

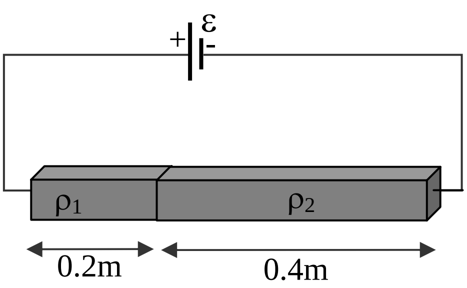


(A) 5.1 (B) 7.6 (C) 10.2 (D) 12.7

Q4- Each plate of a parallel plate air capacitor has an area of 0.0070 m^2. An electric field of (1, 2, 3, 4)$\times10^6$ V/m is present between the plates. The charge (in nC) of the capacitor is:

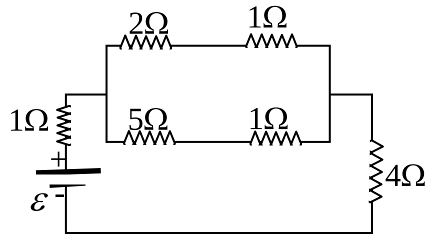
(A) 61.9 (B) 123.9 (C) 185.8 (D) 247.8

Q5- A rod with uniform cross sectional area A is made of two different materials. The first material has a resistivity of 4×10^{-3} Ω.m and is 0.2 m long, while the second material has a resistivity of 6×10^{-3} Ω.m and is 0.4 m long. If the he rod is connected to a (2,4,6,8 V) battery, then the current density (in A/m^2) in the rod is



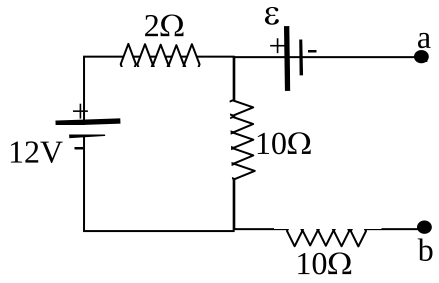
(A) 625 (B) 1250 (C) 1875 (D) 2500

Q6- A battery has an emf of (3.0, 6.0, 9.0, 12.0) V and an internal resistance of 1 Ω is connected in the circuit shown. The power (in W) dissipated in the 2 ohm resistance is:



(A) 0.16 (B) 0.65 (C) 1.47 (D) 2.62

Q7- In the circuit shown, if ε =(8,6,4,2) V then the absolute value of potential difference (in V) between points a and b is:

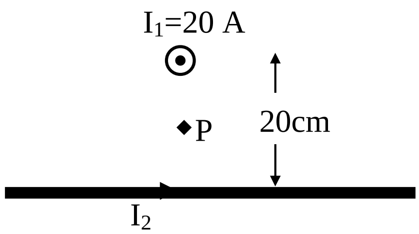


(A) 2 (B) 4 (C) 6 (D) 8

Q8-The kinetic energy (in eV) of an electron that passes without any deflection through perpendicular electric and magnetic fields (E= 4.00 kV/m and B=(8.0,6.0,4.0,2.0)mT is:

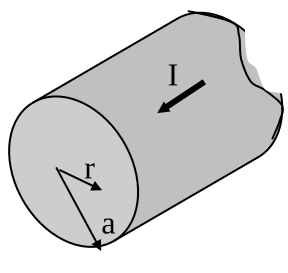
(A) 0.71 (B) 1.26 (C) 2.84 (D) 11.38

Q9-Two long wires are oriented so that they are perpendicular to each other as shown in the figure. If the top wire carries a current of I_1=20.0 A directed out of the page and the bottom one carries a current of I_2=(5.0, 10.0, 15.0, 20.0) A, then the magnitude of the net magnetic field (in μT) at point P, midway between the two wires.



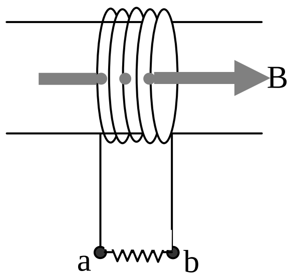
(A) 41.2 (B) 44.7 (C) 50.0 (D) 56.5

Q10-A long, straight wire of radius a=5.0 mm carries a steady current of (1.0, 2.0, 3.0, 4.0) A that is uniformly distributed through the cross-section area of the wire. The magnitude of the magnetic field (in μT) at a distance r= 3.0 mm from the axis of the wire is:



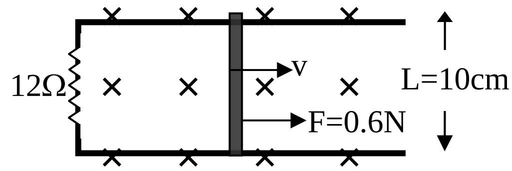
(A) 24 (B) 48 (C) 72 (D) 96

Q11-The coil shown in the figure has 5 turns, a cross-sectional area of 0.20 m^2, and a field (parallel to the axis of the coil) with a magnitude given by $B=(4.0+3.0t^2)$ T, where t is in s. The absolute value of the induced potential difference (in V) between the points a and b at t =(1.0, 2.0, 3.0, 4.0) s is:



(A) 6 (B) 12 (C) 18 (D) 24

Q12-A rod (length = 10 cm) moves on two horizontal frictionless conducting rails, as shown in the figure. The magnetic field in the region is perpendicular to the plane of the rails and is uniform and constant. If a constant force of 0.60 N moves the bar at a constant velocity of (1.0, 3.0, 5.0, 9.0) m/s, then the induced current (in A) through the 12 Ω resistor is:

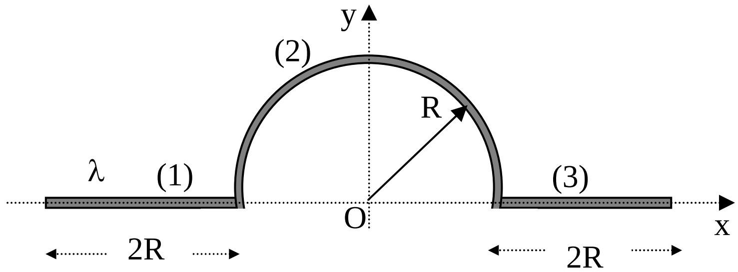


(A) 0.22 (B) 0.39 (C) 0.5 (D) 0.67

Part II: Problems (13marks each)

Problem 1(13 marks)

A uniformly charged thin wire of linear charge density λ is formed as shown in the figure. Calculate the electric potential at point "O" due to wire segments (1), (2), and (3)

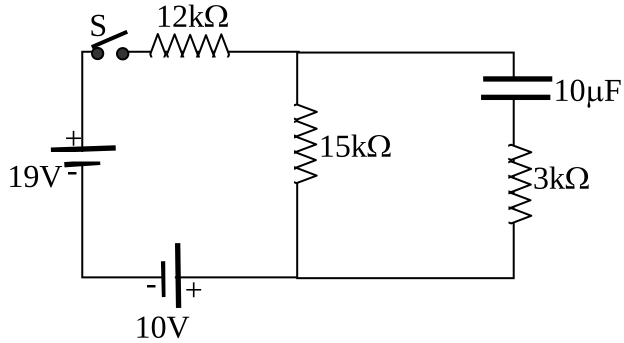


Problem 2 (13 marks)

Consider the circuit shown in the figure.
The capacitor C is first fully charged by closing the switch S for a long time.

(a)- Find the charge on the capacitor.

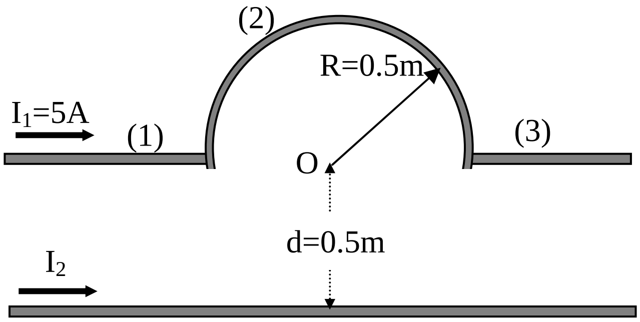
(b) Then, at t=0 the switch S is opened, how long does it take for the charge on the capacitor to fall to ¼ of its initial value.



Problem 3 (13 marks)

A set of current carrying wires is arranged as shown in the figure.

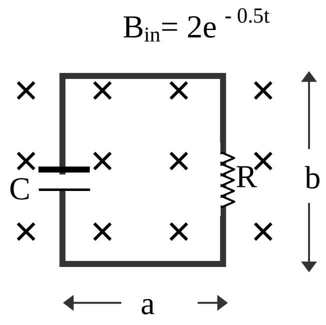
(a)- Find the **net** magnetic (magnitude and direction) field at point "O" due to the wire segments (1), (2), and (3)



(b)- What is the value of current I_2 that should pass in the long straight wire so that the net magnetic field at point "O" is zero?

Problem 4 (13 marks)

An RC circuit with the dimensions shown in the figure is placed at t=0 in a normal magnetic field that varies with time according to $B(t)=2.0e^{-0.5t}$, where B is in Tesla and t is in seconds. Find:



(a)- the magnetic flux through the RC circuit at any time t.
(b)- the induced emf at any time t.
(c)- Show that the differential equation that describes the variation of charge on the capacitor (q) with time (t) is given by: