HOLIDAY HOME WORK
CLASS – XII
SUBJECT – PHYSICS

Assignment I
Section A

1. If Coulomb's Law involved $1/r^3$ dependence (instead of $1/r^2$), would Gauss law be still true? Why? 1
2. Plot a graph showing the variation of resistance of a conducting wire as a function of its length, keeping the radius of the wire and its temperature as constant. 1
3. How will you obtain a resistance of (11/5) Ω from the resistances of 1 Ω, 2 Ω and 3 Ω? 1
4. A narrow beam of protons and alpha particle, each having the same momentum, enters a region of uniform magnetic field directed perpendicular to their direction of momentum. What would be the ratio of the radii of circular paths described by them? 1

Section B

5. Eight identical point charges 1μC each are placed at the corners of a cube of each side 0.1 m. Calculate the electric field at the centre if one of the corner charge is removed. 2
6. How does electric field and electric potential due to a point charge vary with the distance from the point charge? Draw a single graph to show the relationship. 2
7. A wire of 15 Ω resistance is gradually stretched to double its original length. It is then cut into two equal parts. These parts are then connected in series across a 3 volt battery. Find the current drawn from the battery. 2

Section C

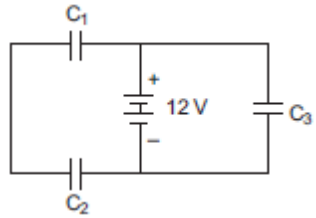
8. Using Gauss's law obtain the expression for the electric field due to an infinite thin sheet of charge. Draw a graph showing the variation of electric field. 3
9. Three identical capacitors C_1, C_2 and C_3 of capacitance 6 μF each are connected to a 12 V battery as shown. 3

   Find:

   (i) charge on each capacitor

   (ii) equivalent capacitance of the network

   (iii) energy stored in the network of capacitors



10. State the principle and theory of Cyclotron giving its labelled diagram. 3

11. Derive an expression for the force experienced by two parallel current carrying wires carrying in same direction and hence define one ampere. 3

Section D

12. (a) Suresh purchased a second hand motor bike and he fixed 6 V dry cell battery to start it but could not start the bike. His friend Varun told him that a simple 6V dry cell battery will not work because its internal resistance is more and it cannot give a desired current of 30 A to switch on the spark plug .Varun suggested that Suresh should use a lead acid battery of 6 V. Suresh accepted his suggestion and got fitted a lead acid battery and his problem was solved. 3

(a) What values were shown by Varun

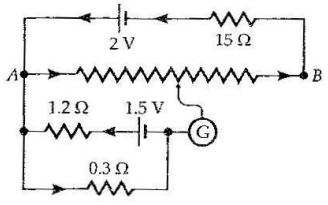
(b) If the internal resistance of dry cell battery is 0.5 Ω, what maximum current can it provide to the spark plug circuit? Given that resistance offered by spark plug is 20 mΩ.

(c) If internal resistance of lead acid battery is 0.01 Ω, what maximum current can it provide to the spark plug?

Section E

13. (a) State the principle of potentiometer. Explain how it is used to find the internal resistance of a cell. 5

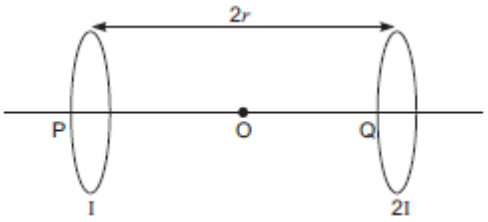
(b) AB is 1 metre long uniform wire of 10 Ω resistances. Other data are as shown in figure. Calculate length when galvanometer shows no deflection.



14. (a) A long straight wire in the horizontal plane carries a current of 50A in the north to south direction. Give the magnitude and direction of B at a point 2.5 m east of the wire. 5

(b) Two identical circular loops, *P* and *Q*, each of radius r and carrying currents I and 2I respectively are lying in parallel planes such that they have a common axis. The direction of current in both the loops is clockwise as seen from *O* which is equidistant from the both loops. Find the magnitude of the net magnetic field at

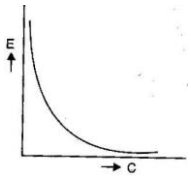
point *O*.



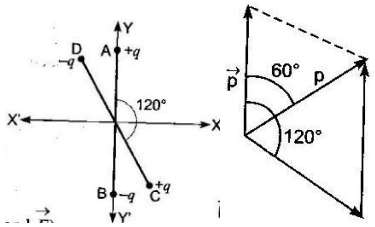
Assignment II

Based on unit 1-electrostatics

1. An electrostatic field line is a continuous curve. That is, a field line cannot have sudden breaks. Why not?
2. Describe schematically equipotential surfaces corresponding to
   (a) A constant electric field in z- direction.
   (b) A field that uniformly increases in magnitude but remains in a constant (say z-) direction.
   (c) A single positive charge at the origin.
3. Vehicles carrying inflammable materials usually have metallic ropes touching the ground during motion. Why?
4. A bird perches on a bare high power line and nothing happens to the bird. A man standing on the ground touches the same line and gets a fatal shock. Why?
5. The graph shown here shows the variation of total energy (E) stored in a capacitor against the value of the capacitance (C) itself. Which of the two: the charge on capacitor or the potential used to charge it is kept constant for this graph?



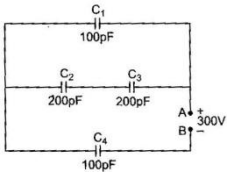
6. Two small identical electrical dipoles AB and CD, each of dipole moment 'p' are kept at an angle of 120^0 as shown in the figure. What is the resultant dipole moment of this combination? If this system is subjected to electric field $(\vec{E})$ directed along + X direction, what will be the magnitude and direction of the torque acting on this?



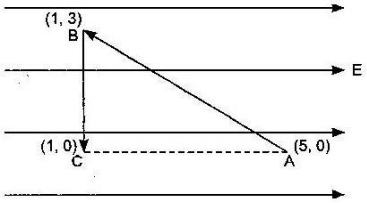
7. A charge 8 mC is located at the origin. Calculate the work done in taking a small charge of -2 x 10^{-9} C from a point A (0, 0, 3 cm) to a point B (0, 4 cm, 0) via point C (0, 6 cm, 9 cm).
8. An electrical technician requires a capacitance of 2 µF in a circuit across a potential difference of 1 kV. A large number of 1 µF capacitors are available to him, each of

which can withstand a potential difference of not more than400 V. Suggest an arrangement that requires a minimum number of capacitors.

9. (a)Obtain the equivalent capacitance of the following network of capacitors.



(b)For a 300 V supply, determine the charge and voltage across each capacitor.

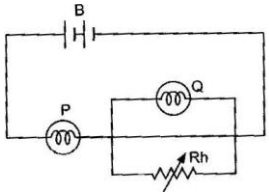
10. 

A test charge 'q' is moved without acceleration from A to C along the path from A to B and then from B to C in electric field E as shown in the figure. (i) Calculate the potential difference between A and C. (ii) At which point (of the two) is the electric potential more and why?

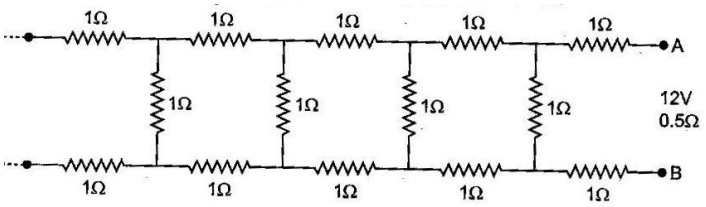
ASSIGNMENT III

Based on unit 2- current electricity

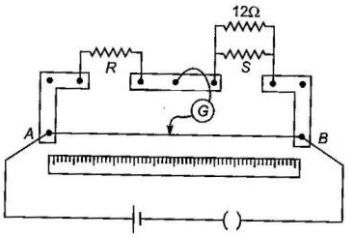
1. The electron drift speed in a metallic conductor is only a few mm s^{-1} for currents in the range of the few amperes. How then is the current established almost at the instant the circuit is closed?
2. When electrons drift in a metal from lower to higher potential, does it mean that the free electrons of the metal are moving in the same direction?
3. Two conducting wires X and Y of same diameter but different materials are joined in series across a battery. If the number density of electrons in X is twice that in Y, find the ratio of drift velocity of electrons in the two wires.
4. Two wires on e of manganin and the other of copper have equal length and equal resistance. Which one of these wires will be thicker?
5. Two 120 V light bulbs, one of 25 W and the other of 200 W were connected in series across a 240 V line. One bulb burnt out almost instantaneously. Which one was burnt and why?
6. A cell of emf E and internal resistance r is connected across an external resistance R. Plot a graph showing the variation of P.D. across R, verses R.
7. Draw the graphs showing the variation of resistivity with temperature for
   (i) nichrome and (ii) silicon.
8. The circuit shown in the diagram contains a battery 'B', a rheostat 'Rh' and identical lamps P and Q. What will happen to the brightness of the lamps, if the resistance through the rheostat is increased? Give reasons.



9. Determine the current drawn from a 12 V supply with internal resistance 0.5 Ω by the infinite network shown in fig. Each resistor has 1 Ω resistance.



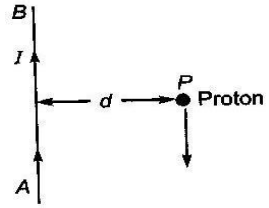
10. In a meter bridge, the null point is found at a distance of 40 cm from A. If a resistance of 12 Ω is connected in parallel with S, the null point occurs at 50.0 cm from A. Determine the values of R and S.



ASSIGNMENT IV

Based on unit 3- magnetic effect of current

1. What is the direction of force acting on a charged particle q moving with a velocity $\vec{v}$ in a uniform magnetic field $\vec{B}$?
2. A long straight wire AB carries a current I. A proton P travels with a speed v, parallel to the wire, at a distance d from it in a direction opposite to the current as shown in figure. What is the force experienced by the proton and what is its direction?



3. An α- particle and a proton moving with the same speed enter the same magnetic field region at right angles to the direction of the field. Show the trajectories followed by the two particles in the region of the magnetic field. Find the ratio of the radii of the circular paths which the two particles may describe.
4. A charge q moving in a straight line is accelerated by a potential difference V. It enters a uniform magnetic field B perpendicular to its path. Deduce in terms of V an expression for the radius of the circular path in which it travels.