



Estd. 1979

Sharjah Indian School

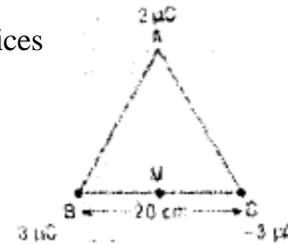
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HOLIDAY ASSIGNMENT in Physics for Class XII

(To be submitted on Wednesday, 07/09/2011)

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1. Find the force on the charge Q placed at the centroid of an equilateral triangle of side 'a' with equal charges q placed on the vertices.
2. Two charges $3 \times 10^{-8} \text{ C}$ and -2×10^{-8} are located 15cm apart. At what point on the line joining the two charges is the electric potential be zero?
3. Draw equi-potential surfaces for a uniform electric field pointing along $+z$ axis.
4. Write the magnitude and direction of electric field intensity due to an electric dipole of length $2a$ at the mid-point of the line joining the two charges.
5. A $4 \mu\text{F}$ capacitor is charged by a 200 V supply. The supply is then disconnected and the charged capacitor is connected to another uncharged $2 \mu\text{F}$ capacitor. How much electrostatic energy of the first capacitor is lost in the process of attaining the steady situation?
6. How does the resistivity of (i) a conductor and (ii) a semiconductor vary with temperature? Give reason for each case.
7. Two fixed point charges $+4e$ and $+e$ units are separated by a distance 'a'. Where should the third point charge be placed for it to be in equilibrium?
8. An electric dipole of dipole moment $20 \times 10^{-6} \text{ C.m}$ is enclosed by a closed surface. What is the net flux coming out of the surface?
9. A parallel plate capacitor with air between the plates has a capacitance of 8 pF. What will be the capacitance if the distance between the plates be reduced by half and the space between them is filled with a substance of dielectric constant $K = 6$?
10. Three point charges of $+2 \mu\text{C}$, $-3 \mu\text{C}$ and $-3 \mu\text{C}$ are kept at the vertices A, B and C respectively of an equilateral triangle of side 20 cm as shown in the figure. What should be the sign and magnitude of the charge to be placed at the mid-point (M) of side BC so that the charge at A remains in equilibrium?



11. How can the sensitivity of a potentiometer be increased?
12. A voltage of 30 V is applied across a carbon resistor with first, second and third rings of blue, black and yellow colours respectively. Find the value of current through the resistor.
13. Two dielectric slabs of dielectric constants K_1 and K_2 are filled in between the two plates, each of area A of the parallel plate of a capacitor as shown in the figure. Find the net capacitance of the capacitor.
14. A small metal sphere carrying charge $+Q$ is located at the centre of a spherical cavity in a large un charged metal sphere as shown in the figure.



Use Gauss' theorem to find electric field at points P_1 and P_2 .

15. A heating element using nichrome connected to a 230 V supply draws an initial current of 3.2 A which settles after a few seconds at a steady value of 2.8 A. What is the steady temperature of the heating element if the room temperature is 27°C. Temperature coefficient of resistance of nichrome averaged over the temperature range involved is $1.7 \times 10^{-4} \text{C}^{-1}$

16. Two primary cells of e.m.f. E_1 and E_2 ($E_1 > E_2$) are connected to the potentiometer wire AB as shown in the figure.

The balancing lengths for the two combinations are 250 cm and 400 cm, find the ratio of E_1 and E_2 .

17. In a metre bridge, the balance point is found to be at 39.5 cm from the end A, when the resistor Y is of 12.5 ohm.

Determine the resistance of X. Why are the connections between resistors in a metre bridge made of thick copper strips? What happens if the galvanometer and cell are interchanged at the balance point of the bridge? Would the galvanometer show any current?

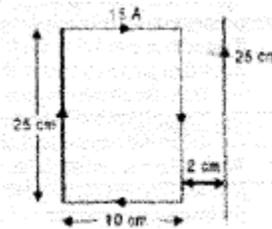
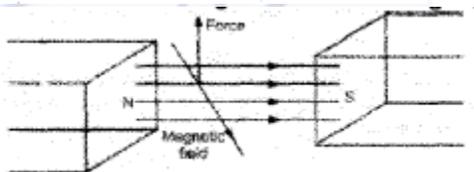
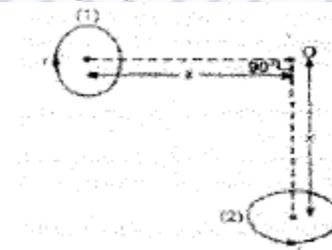
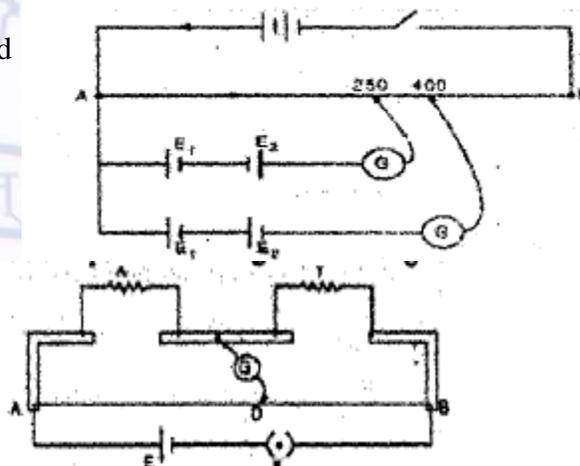
18. An electron beam projected along + X-axis experiences a force due to the magnetic field along the +Y-axis. What is the direction of the magnetic field?

19. A galvanometer with a coil of resistance 120 ohm shows full scale deflection for a current of 2.5 mA. How will you convert the galvanometer into an ammeter of range 0 to 7.5 A? Determine the net resistance of the ammeter. When an ammeter is put in a circuit, does it read slightly less or more than the actual current in the original circuit? Justify your answer.

20. Two small identical circular loops, marked (1) and (2), carrying equal currents, are placed with the geometrical axes perpendicular to each other as shown in the figure. Find the magnitude and direction of the net magnetic field produced at the point O.

21. A charged particle enters into a uniform magnetic field and experiences an upward force as indicated in the figure. What is the charge sign on the particle?

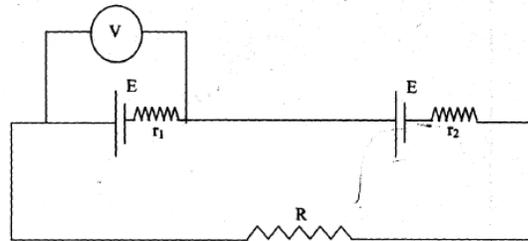
22. Figure shows a rectangular current-carrying loop placed 2 cm away from a long, straight, current carrying conductor. What is the direction and magnitude of the net force acting on the loop?



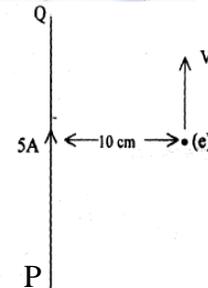
23. A short bar magnet of magnetic moment 0.9 joule/ tesla, is placed with its axis at 45° to a uniform magnetic field. If it experiences a torque of 0.063joule, (i) calculate the magnitude of the magnetic field and (ii) what orientation of the bar magnet corresponds to the stable equilibrium in the magnetic field ?
24. A potential difference of V volt is applied across a copper wire of length l and diameter d . How will the drift velocity be affected if-

- (i) V is doubled
 (ii) l is doubled.

25. Two cells of same emf E , but different internal resistance r_1 and r_2 are connected to an external resistance R as shown. in the figure. The voltmeter V reads zero. Obtain an expression for R in terms of r_1 and r_2 . Calculate the voltage across the cell of internal resistance r_2 . (Assume that the voltmeter V is of infinite resistance).



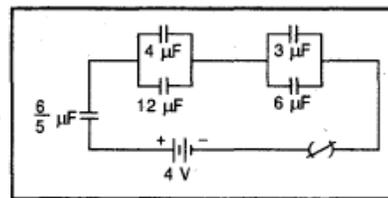
26. In the figure given below, PQ is a long straight wire carrying a current of 5A in the direction of the arrow. An electron travels with a velocity of 10^6 m/s at a distance 10 cm from the wire in the same direction of the current. Calculate the magnitude and direction of the force experienced by the electron.



27. A straight wire, of length L , carrying a current I , stays suspended horizontally in mid air in a region where there is a uniform magnetic field B . The linear mass density of the wire is λ . Obtain the magnitude and direction of this magnetic field.

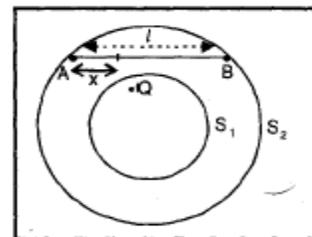
28. A charged particle, having a charge q , is moving with a speed v along the x-axis. It enters a region of space 'where an electric field $E (= E \mathbf{j})$ and a magnetic field B are both present. The particle, on emerging from this region, is observed to be moving along the x-axis only. Obtain an expression for the magnitude of B in terms of v and E . Give the direction of B .

29. Find (i) the equivalent capacitance and (ii) the total energy stored in the system of capacitors given in the network.



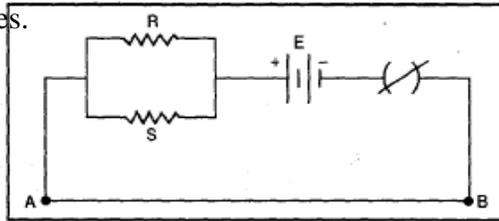
The charging battery has an emf of 4V.

30. In the figure shown, calculate the total flux of the electrostatic field through the spheres S_1 and S_2 . The wire, AB, shown here, has a linear charge density, λ given by $\lambda = kx$ where x is the distance measured along the wire, from the end A.



31. A cell, of emf 4 V and internal resistance 0.5Ω , is connected across a load of resistance (i) 7.5Ω , (ii) 11.5Ω . Calculate (i) the ratio of the differences in the emf of the cell and the potential drop across the load, and (ii) the ratio of the currents in the two cases.

32. A potentiometer wire has a length L and a resistance R_0 . It is connected to a battery and a resistance combination as shown.



Obtain an expression for the potential drop per unit length of this potentiometer wire.

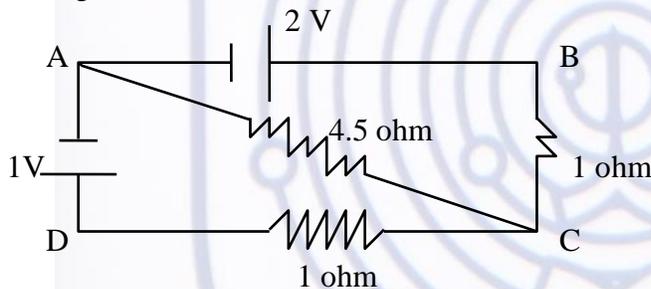
What is the maximum emf of a 'test cell' for which one can get a 'balance point' on this potentiometer wire? What precaution should one take, while connecting this 'test cell', in the circuit?

33. A series battery of 10 lead accumulators each of emf 2 V and internal resistance 0.25 ohm is charged by a 220 V D.C. mains to limit the charging current a resistance of 47.5 ohm is used in series in the charging circuit. What is a) the power supplied by the mains and b) power dissipated as heat? Account for the difference of powers is (a) and (b).

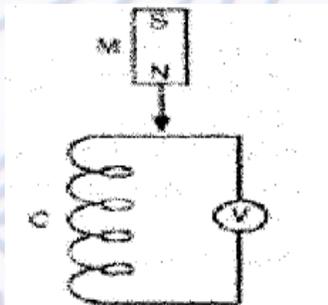
34. A proton moves with a speed of $7.45 \times 10^5 \text{ m/s}$ directly towards a free proton originally at rest. Find the distance of the closest approach for the two protons. (Given: mass of proton = $1.67 \times 10^{-27} \text{ kg}$ and $e = 1.6 \times 10^{-19} \text{ C}$)

35. The electron in the hydrogen atom circles around the proton with a speed of $2.18 \times 10^6 \text{ m/s}$ in an orbit of radius $5.13 \times 10^{-11} \text{ m}$. What magnetic field does it produce at the centre?

36. By applying kirchoff's laws, calculate the current flowing through each resistance in the network shown in this diagram.



37. Figure shows a bar magnet M falling under gravity through an air cored coil C . Plot a graph showing the variation of induced e.m.f (E) with time (t). What does the area enclosed by the $E - t$ curve depict ?



38. Figure (a), (b) and (c) show three a.c. circuits in which equal currents are flowing. If the frequency of emf be increased, how will the current be affected in these circuits? Give reason for your answer.

