I Term Exam - 2017-18

CLASS XII B

M.M:- 70

Time - 3hrs.

PHYSICS

ϕ_e

$E.ds \quad \phi \quad = \oint \vec{E}.d\vec{s}$

General Instructions :-

1). All questions are compulsory.
2). Q 1 – 5 are VSA of 1 mark each.
3) Q 6 - 10 are SA of 2 marks each.
4). Q - 11 – 22 are SA of 3 marks each.
5). Q 23 is value based question of 4 marks.
6). Q 24 - 26 is LA of 5 marks each.

SECTION A

Q1). What is the electric flux through a cube of of side 1 cm. which encloses an electric dipole?

Q2). "For any charge configuration, equipotential surface through a point is normal to the electric field." Justify.

Q3) A cell of emf 'E' and internal resistance 'r' draws a current 'I'. Write the relation between terminal voltage 'V' in terms of E, I and r.

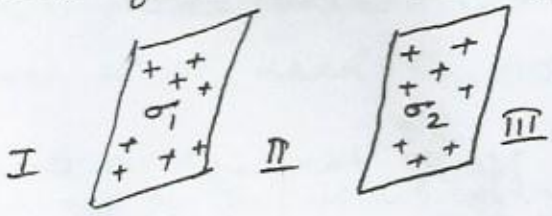
Q4). Define one tesla using the expression for the magnetic force acting on a particle of charge 'q' moving with velocity $\vec{v}$ in a uniform magnetic field $\vec{B}$.

Q5) What are parmanent magnets? Which of the following substances are deamagnetic?
Bi, Al, Na, Cu, Ca & Ni.

(2) SECTION B

Q6) (a) A point charge (+Q) is kept in the vicinity of uncharged conducting plate. Sketch electric field lines between the charge and the plate.

(b) Two infinitely large plane thin parallel sheets having surface charge densities σ_1 and σ_2 ($\sigma_1 > \sigma_2$) are shown in the figure below. Write the magnitudes and directions of net fields in the regions marked I, II & III.



Q7) An electric dipole of length 4 cm., when placed with its axis making an angle of 60° with a uniform electric field, experiences a torque of $4\sqrt{3}$ Nm. Calculate the potential energy of the dipole, if it has charge ± 8 nC.

Q8) Use Kirchoff's rules to obtain the balanced conditions in a wheatstone bridge.

Q9) An ammeter of resistance 0.8 Ω can measure current upto 1.0 A.

(i) What must be the value of shunt resistance to enable the ammeter to measure current upto 5 A ?

(ii) What is the combined resistance of the ammeter and the shunt ?

(i) Why do magnetic lines of force form continuous closed loops?

(ii) Why are the field lines repelled when a diamagnetic material is placed in an external uniform magnetic field?

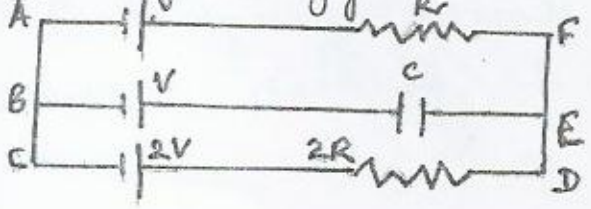
SECTION C

Q11). Using Gauss's law obtain the expression for the electric field due to a uniformly charged thin spherical shell of radius R at a point outside the shell. Draw a graph showing the variation of electric field with r, for $r > R$ and $r < R$.

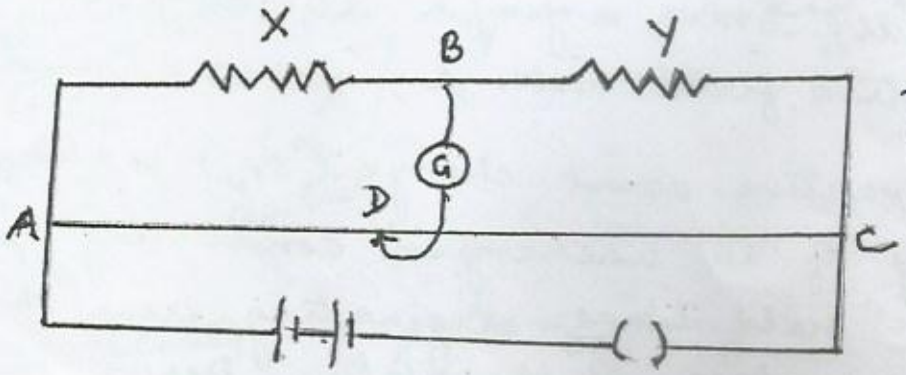
Q12) A positive point charge (+q) is kept in the vicinity of an uncharged conducting plate. Sketch electric field lines originating from the point on to the surface of the plate. Derive the expression for the electric field at the surface of a charged conductor.

Q13) A 600 pF capacitor is charged by a 200 V supply. It is then disconnected from the supply and is connected to another uncharged 300 pF capacitor. Calculate how much electrostatic energy is lost in the process. What is the source of energy loss?

Q14). In the given circuit in the steady state, obtain the expressions for (a) the potential drop, (b) the charge and (c) the energy stored in the capacitor C?



Q15) The figure shows experimental set up meter bridge. When the two unknown resistances X and Y are inserted, the null point D is obtained 40 cm. from the end A. When a resistance of 10 Ω is connected in series with X, the null point shifts by 10 cm. Find the position of the null point when the 10 Ω resistance is instead connected in series with resistance Y. Determine the values of the resistances X and Y.



T = 2π

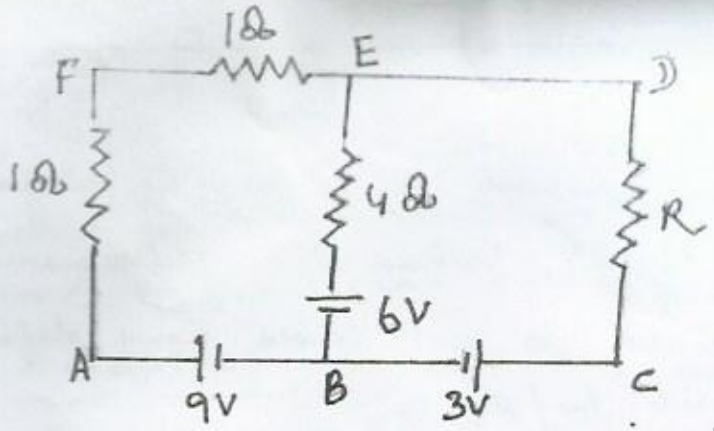
Q16) Answer the following:

a). Why are the connections between the resistors in a meter bridge made of thick copper strips?

b). Why is it generally preferred to obtain the balance point in the middle of the meter bridge wire?

c). Which material is used for the meter bridge wire and why?

Q17). Using Kirchoff's rules, determine the value of unknown resistance R in the circuit so that no current flows through 4 Ω resistance. Also find the p.d. between A and D.



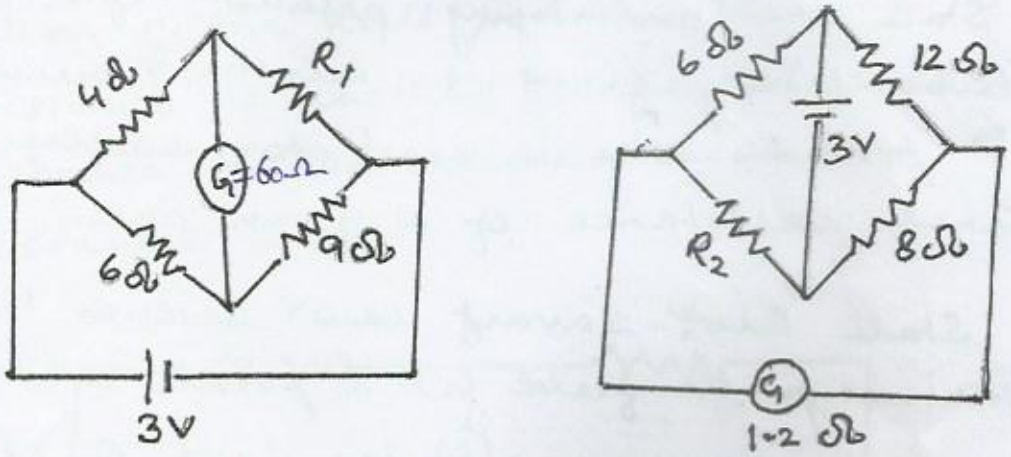
Q18). State the underlying principle of a potentiometer. Describe briefly, giving the necessary circuit diagram, how a potentiometer is used to measure the internal resistance of a given cell.

Q19). State Biot-Savart law. Deduce the expression for the magnetic field at a point on the axis of a current carrying circular loop of radius 'R', distance 'x' from the centre. Hence, write the magnetic field at the centre of a loop.

Q20) a) Two long straight parallel conductors 'a' and 'b', carrying steady currents I_a and I_b are seperated by a distance d. Write the magnitude and direction of the magnetic field produced by the conductor 'a' at the points along the conductor 'b'. If the currents are flowing in the same direction, what is the nature and magnitude of the force between the two conductors?

b). Show with the help of a diagram how the force between the two conductors would change when the currents in them flow in the opposite directions.

(6) Q21) Define the current sensitivity of a galvan
Write its SI. unit.
Figure shows two circuits each having a galvanomet
and a battery of 3V. When the galvanometers in
each arrangement do not show any deflection,
obtain the ratio R_1/R_2.



Q22). A long solenoid of length 'l' having N turns carries a current I. Deduce the expression for the magnetic field in the interior of the solenoid.

Value based questions :-

Q23). Sushil is in the habit of charging his mobile and then leaving the charger connected through the mains with the switch on. When his sister Asha pointed it out to him, he replied there was no harm as the mobile had been disconnected. Asha then explained to him and convinced him, how the energy was still being wasted as the charger was continuously consuming energy.
Answer the following questions :-

a). What values did Asha display in convincing her brother?

b). What measures, in your view, should be adopted to minimise the wastage of electric

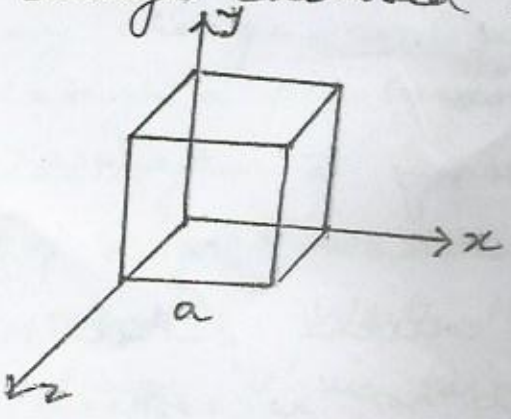
Energy in your households?

c). Imagine an electric appliance of 2 W, left connected to the mains for 20 hours. Estimate the amount of electrical energy wasted.

SECTION D

Q24) a) An electric dipole of dipole moment $\vec{P}$ consists of point charges $+q$ and $-q$ separated by a distance $2a$ apart. Deduce the expression for the electric field $\vec{E}$ due to the dipole at a distance x from the centre of the dipole on its axial line in terms of the dipole moment $\vec{P}$. Hence show that in the limit $x \gg a$, $\vec{E} \to 2\vec{P}/4\pi\epsilon_0 x^3$.

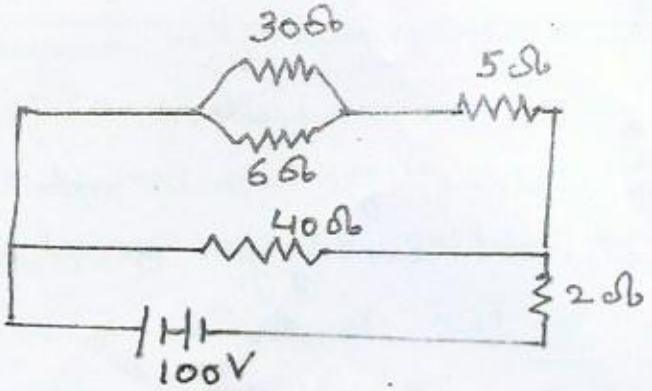
b). Given the electric field in the region $\vec{E} = 2x\,\hat{i}$, find the net electric flux through the cube and the charge enclosed by it.



Q25). (a) Define the term 'drift velocity' of charge carriers in a conductor. Obtain the expression for the current density in terms of relaxation time.

(b) A 100 V battery is connected to the electric network as shown. If the power consumed in the 2 Ω resistor is 200 W, determine the power dissipated in the 5 Ω resistor.

(8)



Q.26) a) Deduce an expression for the frequency of revolution of a charged particle in a magnetic field and show that it is independent of velocity or energy of the particle.

b). Draw a schematic sketch of a cyclotron. Explain, giving the essential details of its construction and how it is used to accelerate the charged particles.

OR

a) Draw a labelled diagram of a moving coil galvanometer. Describe briefly its principle and working.

b). Answer the following:

(i) Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer?

(ii) Increasing the current sensitivity of a galvanometer may not necessarily increase its voltage sensitivity. Explain, giving reason.