Std. 12 Time : 3 hrs.

9-9-2015 Half Yearly Examination in PHYSICS (Set - I) M. Marks : 70

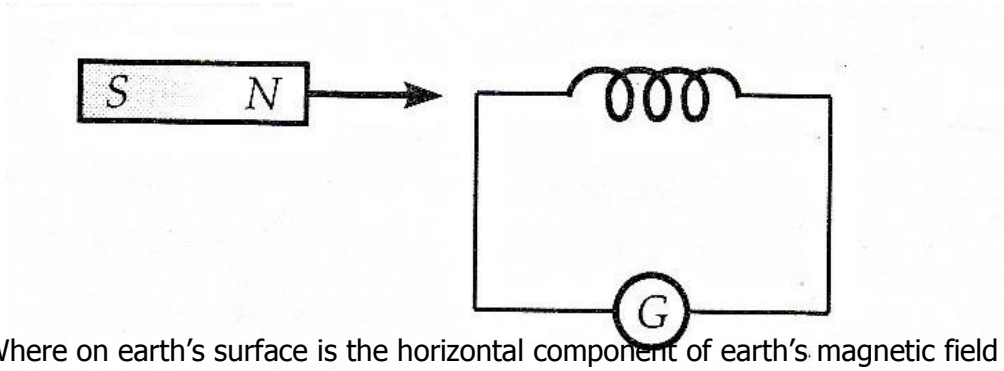
INSTRUCTIONS:

i) Q. Nos. 1 to 5 carry 1 mark each.
ii) Q. Nos. 6 to 10 carry 2 marks each.
iii) Q. Nos. 11 to 22 carry 3 marks each.
iv) Q. No. 23 carries 4 marks.
v) Q. Nos. 24 to 26 carry 5 marks each.
vi) Use pencil for the diagrams and graphs.
vii) Answers should be to the point.
viii) Use log tables if necessary

1. A car battery is of 12V. Eight dry cells of 1.5V in series also give 12V, but such a combination is not used to start a car. Why?

2. A beam of α particle projected along the positive X axis experiences a force due to magnetic field along the positive Y axis. What is the direction of magnetic field?

3. Will there be any current induced in the coil shown in the figure if the bar magnet is swiftly moved towards the coil? Justify your answer.



4. Where on earth's surface is the horizontal component of earth's magnetic field zero?

5. Write two characteristics of stable equilibrium condition of an electric dipole placed in a uniform electric field.

6. You are given two constantan wires P and Q of length area of cross-section (L, A) and (2L, A/2) respectively. When two wires are connected in series, effective resistance is R_s and R_p when connected in parallel. Calculate R_s/R_p.

(OR)

An external resistance 'R' is connected across a source of emf 'E' and internal resistance 'r'. Write the relation between terminal voltage and 'R'. Sketch a graph of terminal voltage versus 'R'. Justify the shape of the graph.

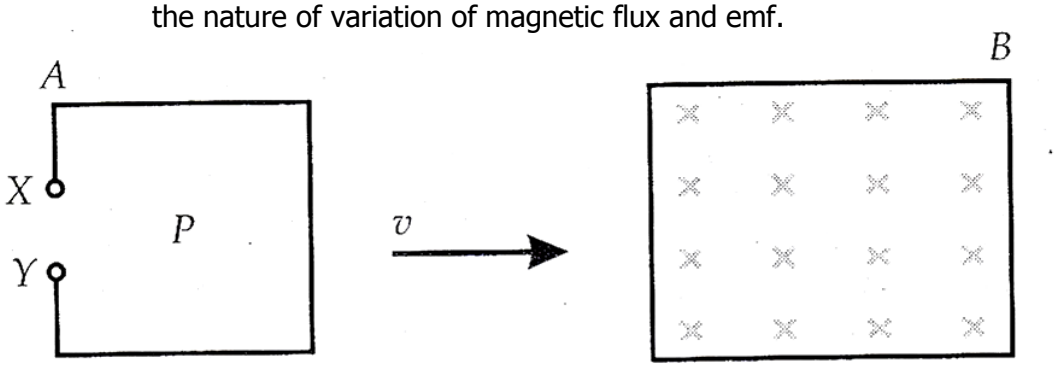
7. The magnitudes of velocities of an alpha particle and proton entering in a magnetic field are in the ratio of 6:1. On entering the field, they move on the circular paths.

Find the ratio of radii of their circular paths.

8. A rectangular coil is moved from a point A to another point B with uniform velocity V through region of uniform magnetic field acting normally inwards as shown in the figure.
Show graphically

(i)the variation of magnetic flux associated with the coil with time .

(ii) variation of induced emf across points X and Y of the coil with time. Also explain the nature of variation of magnetic flux and emf.



9. (i)A short bar magnet placed with its axis at 30° with a uniform external magnetic field of 0.25T experiences the torque of magnitude equal to 4.5X 10^{-2}J. What is the magnitude of the magnetic moment of the magnet?

(ii) A magnet of length 14cm and magnetic moment M is broken into two parts of length 6cm and 8cm.These are put at right angles to each other with opposite poles together. Calculate the magnetic moment of the combination.

10. Derive an expression for the electric field at a point on the right bisector of an electric dipole.

Write two characteristics of this electric field.

11. A pendulum having a charged bob of mass 50 gm is in an electric field of (4 $\hat{i}$ – 3 $\hat{j}$) x 10^3N/C

is in equilibrium making an angle of 37° with vertical. Calculate the charge on the bob andtension in the string?

12. State the principle of a potentiometer. Explain; how can it be used to compare the emfof two cells with help of neat circuit diagram.

13. Explain how two parallel current carrying wires carrying the currents in the same direction experience mutual force of attraction. Derive the expression for force acting per unit length of one wire due to another wire. Hence define one ampere of current.

14. A length of uniform heating wire made of nichrome has a resistance 72Ω. At what rate is the energy dissipated if a potential difference 0f 120V is applied across (i) full length of wire (ii) half-length of wire(wire is cut into two). Why it is not advisable to use the half length of wire?

15. State the working principle of a galvanometer. What do you mean by figure of merit? Explain how a galvanometer can be converted in to an ammeter.

16. Explain the pattern of magnetic field produced a solenoid and toroid with help of neat diagram. Write the expression for the magnetic field produced by a solenoid at centre of solenoid and on the axis. Suggest a method to increase the magnetic field.

17. Define root mean square value of an alternating current. Derive the relation between RMS value and peak value of current.

(OR)

What do you mean by mean value of alternating current over a half cycle? Derive its relation.

18. The distance between the parallel plates of a charged condenser is 5 cm and the intensity of electric field is 300 V/cm. A slab of dielectric constant 5 and 1 cm wide is inserted parallel between the plates. Determine potential difference between the plates before and after the slab is inserted. If the slab is replaced by a metal plate so that the final potential difference remains unchanged. What must be the thickness of the plates?

19. What do you mean by mutual inductance of two nearby coils. Two concentric circular coils, one of small radius r_1 and other of large radius r_2 such that $r_2 << r_1$ are placed coaxially with their centers coinciding. Obtain the mutual inductance of the arrangement.

20. A wheel having 8 spokes,10 cm in radius rotates at 20π rad/s about an axis through its centerand perpendicular to the plane of the wheel. A uniform magnetic field of 0.2 T acts perpendicular to the plane of the wheel.

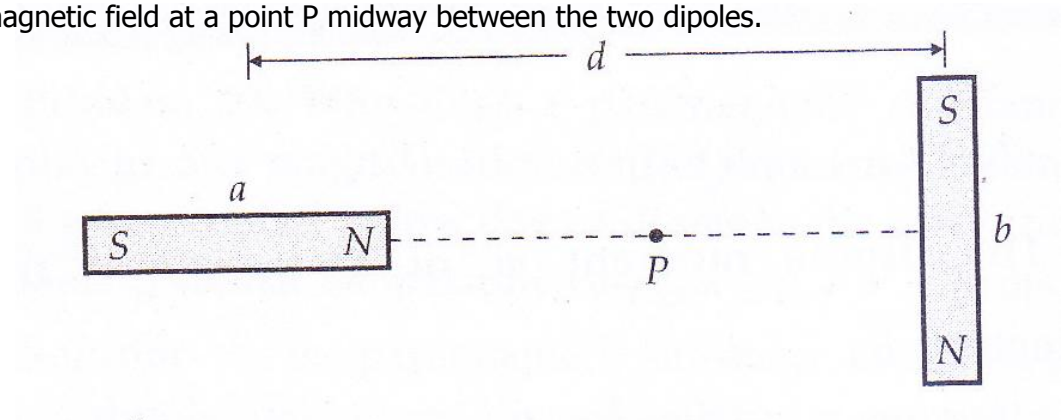
(i) Calculate the potential difference developed between the axis of the wheel and the rim.

(ii) What is the induced current in the circuit whose terminals are connected between the center of the wheel and the point of rim, given the resistance of the circuit is 2 ohm?

(iii) How will the value of emf be affected if the number of spokes is increased?

21. Depict the behaviour of magnetic field lines when (ii) a diamagnetic material (ii) a paramagnetic material is placed in an external magnetic field. Mention briefly any two properties of these materials which explain this distinguishing behaviour.

22. Two identical short bar magnets a and b of magnetic moments m each are placed at a distance 'd' with their axes perpendicular to each other as shown in the figure. Find the net magnetic field at a point P midway between the two dipoles.



23. A retired teacher was working in his field along with his grandson. There was a big high tension tower supporting high tension cables located in their fields. The grandson argues that the tower should be removed from their fields so that more space could be created for the crops. Mr. Gupta explained the necessity of such towers for transmission of electric energy from one place to another. Answer the following questions based on the above information:

(i) Why is the electrical energy for long distance transmission is done at high voltage? Which device is used to bring down this high voltage to low usable voltage at the receiving end?

(ii) Can this device work on direct current?

(iii) Which undesired attitude and value was the grandson displaying in marking his observation? How was he corrected by his grandfather?

24. (i) State Ampere's circuital law, use this law to obtain magnetic field intensity due to thick straight current carrying wire at the points(a) r>R (b) r<R , where R is radius of cross-section of the wire and r is the perpendicular distance of the point from the center of cross-section of the wire.

(ii) Show the variation of magnetic field intensity with the distance and justify the shape of the graph.

(3½+1½)

(OR)

Write an expression for the force experienced by a charged particle moving in a uniform magnetic field B. With the help of diagram, explain the principle and working of a cyclotron.

Show that cyclotron frequency does not depend on the speed of the particle.

(5)

25. (i) Explain polarization of a dielectric in a uniform electric field E_0. Show that electric field inside the dielectric is given by E_0 / K, where K is the dielectric constant.

(ii) Establish a relation to show that if the gap between the plates of a parallel plate capacitor is completely filled with a dielectric of dielectric constant K its capacitance increases by an amount K.

(2+3)

(OR)

(i) State Gauss's theorem. Use this theorem to calculate the electric field intensity at a point 'P' which is at a distance 'x' normally from an infinitely long and straight charged wire of linear charge density 'λ'.

(ii) Electric field intensity at point 18 cm from an infinitely long uniformly charged straight

wire is 10 x 10^4 N/C. Calculate its linear charge density.

(3+2)

26. Two cells, E1 of emf 6 V, internal resistance 1 Ω and E2 of emf 3 V internal resistance 0.5 Ωare joined in parallel with their like terminals together. The combination is then connected across a parallel combination of two 10 Ω resistances. Draw the circuit diagram of the givenconnection. Using Kirchoff's law calculate the current through each resistance and terminal potential difference of each cell. (5)

(OR)

(i) Using the expression of current in terms of drift velocity derive an expression for theresistivity of a conductor. Give reason why the resistivity of a conductor increases with the increase of temperature.

(ii) Two resistance wires of same material having same length but different cross section are joined in series. Determine the ratio of drift velocity in the two wires.

(3+2)

-x-x-x-x-x-x-x-x-x-