विद्या सर्वार्थ साधिका

ANANDALAYA

PERIODIC TEST – 1

Class : XII

Subject: Physics M.M: 40

Date : 19/07/2019 Time: 2 Hours

General Instructions

1. All questions are compulsory. There are 20 questions in all.
2. This question paper has four sections: Section A, Section B, Section C, and Section D.
3. Section A contains ten questions of one mark each, Section B contains four questions of two marks each, Section C contains four questions of three marks each and Section D contains two questions of five marks each.
4. You may use the following values of physical constants wherever necessary.

$g = 10\ m/s^2$ $m_e = 9.1 \times 10^{-31}\ kg$

$c = 3 \times 10^8\ m/s$ $e = 1.6 \times 10^{-19}\ C$

$h = 6.63 \times 10^{-34} Js$ $\frac{\mu_0}{4\pi} = 10^{-7}\ TAm$

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9\ Nm^2C^{-2}$

SECTION A

1. Define electric dipole moment (1)

2. Two charges of magnitudes -2Q and +Q are located at points (a,0) and (4a,0) respectively. What is the electric flux due to these charges through a sphere of radius 3a with its centre at the origin? (1)

3. Two point charges having equal charges separated by 1m distance experience a force of 8N. What will be the force experienced by them, if they are held in water at the same distance? (Given relative permittivity of water is 80) (1)

4. What is the potential at a point inside a charged spherical shell (charge = Q) of radius R? (1)

5. In which orientation an electric dipole placed in a uniform electric field is in (i) stable and (ii) unstable equilibrium? (1)

6. Three capacitors C_1=12μF, C_2 = 24 μF and C_3 = 24 μF are connected parallel. What is the equivalent capacitance of this combination? (1)

7. What is the difference between electromotive force and terminal potential difference of a cell? (1)

8. Give reason why a potentiometer is preferred over a voltmeter for the measurement of emf of a cell. (1)

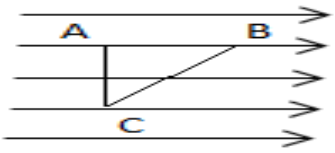
9. A charge is entering a uniform magnetic field. What is the direction of velocity if the Lorentz force acting on it is zero? (1)

10. An electric charge enters a region of electric and magnetic field where electric and magnetic field and the velocity of the charge are mutually perpendicular. What will be the effect on the motion of the charge, if the $\frac{E}{B}$ ratio is equal to the speed of the charge? (1)

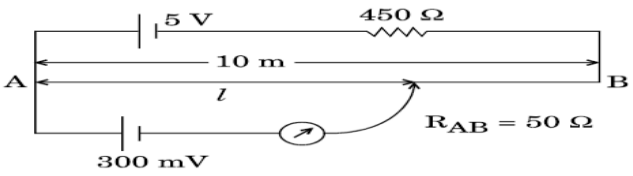
SECTION B

11. Derive the expression for electric field due to an electric dipole at a point on the axial line. (2)

12. Calculate the workdone in taking a charge of 1 C along the path ACB in a uniform electric field of 10 V/m? Given AC = 3 cm, AB = 4 cm and CB = 5 cm. (2)



13. Give reason, whether the potentiometer circuit given below will work, if the driver cell of emf 5 V is replaced with a cell of 2 V, keeping all other factors constant. (2)



14. Describe the working of a moving coil galvanometer. (2)

SECTION C

15. A system has two charges $q_A = 2.5 \times 10^{-7}$ C and $q_B = -2.5 \times 10^{-7}$ C located at points A: (0, 0, –15 cm) and B: (0,0, +15 cm), respectively. (3)
    (a) What are the total charge and electric dipole moment of the system?
    (b) What will be the torque experienced by this dipole of placed in a uniform electric field of 10 V/m at an angle of 30° with the electric field?

16. (a) Draw an equipotential surface due to a single point charge. (3)
    (b) Can two equipotential surfaces intersect each other?
    (c) How can you say that the surface of a charged conductor is an equipotential surface?

17. (a) State the working principle of a meter bridge used to measure an unknown resistance. (3)
    (b) Give reason
    (i) Why the connections between the resistors in a metre bridge are made of thick copper strips?
    (ii) Why is it generally preferred to obtain the balance length near the mid-point of the bridge wire?

18. (a) What is 1 bohr magneton? (3)
    (b) In a Hydrogen atom the electron is making 6.6 x 10^{15} revolutions per second in a circular path of radius 0.53 A°. Estimate the magnetic induction at the centre of the orbit.

SECTION D

19. (a) Explain, using suitable diagrams, the difference in the behaviour of a (i) conductor and (ii) dielectric in the presence of external electric field. Define the terms polarization of a dielectric and write its relation with susceptibility. (5)
    (b) A thin metallic spherical shell of radius R carries a charge Q on its surface. A point charge $\frac{Q}{2}$ is placed at its centre C and another charge +2Q is placed at a point A outside the shell at a distance *x* from the centre. Find (i) the force on the charge $\frac{Q}{2}$ at the centre C of shell and +2Q at the point A, (ii) the electric flux through the shell.

20. (a) Derive the expression for magnetic field around an infinitely long straight current carrying using Ampere circuital law. (5)

    (b) A very long thick wire of radius R is carrying a current I. Find the magnetic field (a) at a point outside the wire r distance from the centre (r > R) and (b) at a point inside the wire r distance from the centre (r < R).