MATA SAVITRI DEVI SANJEEVANI PUBLIC SCHOOL

CLASS- XII ELECTROSTATICS SUBJECT: PHYSICS

BY RUPESH GUPTA SIR

ELECTRIC FIELD

ASSIGNMENT NO: -3

NAME OF STUDENT: - **ROLL NO: -**

Q1. Sketch the electric field lines for two point charges q_1 and q_2 for $q_1 = q_2$ and $q_1 > q_2$ separated by a distance d.

Q2. Why do the electrostatic field lines not form closed loops?

Q3. What is the angle between the directions of electric field at any?

(i) Axial point and

(ii) Equatorial point due to an electric dipole?

Q4. An electric dipole of dipole moment 20×10^{-6} C-m is enclosed by closed surface. What is the net electric flux coming out of this surface?

Q5 An electric dipole is held in a uniform electric field.

(i) Show that the net force acting on it is zero.

(ii) The dipole is aligned parallel to the field. Find the work done in rotating it through the angle of 180^0

Q6. A spherical conducting shell of inner radius r_1 and outer radius r_2 has a charge 'Q'. A charge 'q' is placed at the centre of the shell.

(a) What is the surface charge density on the (i) inner surface (ii) outer surface of the shell?

(b) Write expression for the electric field at a point $x > r_2$ from the centre of the shell.

Q7. A proton and an electron are placed freely in an electric field. Which of the particles will have greater acceleration and why?

Q8. Two point charges of $+5 \times 10^{-19}$ C and $+ 20 \times 10^{-19}$ C are separated by a distance of 2 m. Find the point on the line joining them at which electric field intensity is zero.

Q9. Two point charges $q_A = + 3$ μC and $q_B = - 3$μC are located at point A and B , 20 cm apart in vacuum. (a) What is the electric field at the midpoint of the line AB joining the two charges? (b) If a negative test charge of magnitude 1.5×10^{-9}C is placed at this point, what is the force experienced by the test charge?

Q10. What orientation of an electric dipole in a uniform electric field corresponds to its (i) stable and (ii) unstable equilibrium?

Q11. The graph shown here show 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?

Q12. A small sphere of mass 1 g carries a charge of +6 μC. The sphere is suspended by a string in an electric field of 400 NC^{-1} acting downwards .Calculate tension in the string. What will be the tension if charge on sphere were – 6 μC?

Q13. Two charges each of 1 μ C but opposite in sign are 1 cm apart. Calculate electric field at a point distant 10 cm from the midpoint on axial line of the dipole.

Q14. What is the magnitude of electric intensity due to a dipole of moment 2×10^{-8} C-m at a point distant 1 m from the centre of dipole, when line joining the point to the centre of dipole makes an angle of 60^0 with dipole axis?

Q15. An electric dipole consists of two charges of ±0.1 μ C separated by a distance of 2.0cm. The dipole is placed in an external field of 10^5 N/C. What maximum torque does the field exert on the dipole?

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Q16. An electric dipole of moment 5 x 10^{-8} C-m is aligned in a uniform electric field of 1.44 x 10^4 N/C. Calculate potential energy of the dipole to hold the dipole at 60^0 with the direction of electric field.

Q17. A pendulum bob of mass 80 milligram and carrying a charge of 2 x 10^{-8} C is at rest in horizontal uniform electric field of 2 x10^4 Vm^1. Find the tension in the thread of the pendulum and the angle it makes with the vertical.

Q18. Two charged particles of masses 4m and m and having charges +q and +3q are placed in uniform electric field and allowed to move for 2 sec. find the ratio of kinetic energies acquired by them.

Q19. An electron is liberated from the lower of the two large parallel metal plates separated by distance of 20 mm . The upper plate has a potential of + 2400 V relative to the lower plate. How long does the electron take to reach the upper plate? Take e/m of electron 1.8 x 10^{11} C kg^{-1}.

Q20. A stream of electrons moving with a velocity of 3 x10^7 ms^{-1} is deflected by 2 mm in traversing a distance of 0.1 m in a uniform electric field of strength 18 V cm^{-1}. Determine e/m of electrons.

Q21. A charged oil drop remains stationary when situated between two parallel plates 20 mm apart and a p.d. of 500 V is applied to the plates. Find the charge on the drop if it has a mass of 2 x 10^{-4} kg. Take g =10 ms^{-2}.

Q22. In Millikan's experiment, an oil drop of radius 10^{-4} cm remains suspended between the plates which are 1 cm apart. If the drop has charge of 5e over it, calculate the potential difference between the plates. The density of oil may be taken as 1.5gcm $^{-3}$.

Q23. Two point charges q_1= +0.2 C and q_2= + 0.4 C are plated 0.1 m apart. Calculate the electric field at (a) the midpoint between the charges. (b) a point on the line joining q_1 and q_2 such that it is 0.05m away from $q_2$and 0.15 m away from q_1.

Q24. ABCD is a square of side 5 m. Charges of +50 C, - 50 C and +50 C are placed at A, C and D respectively . Find the resultant electric field at B.

Q25. Two point charges +6q and -8q are placed at the vertices 'B' and 'C' of an equilateral triangle ABC of side 'a' as shown in fig. 1.51 (a). Obtain the expression for (i) the magnitude and (ii) the direction of the resultant electric field at the vertex A due to these two charges.

Q26. A charged spherical conductor has a surface density of 0.7 cm^{-2} . When its charge is increased by 0.44 C, the charge density changes by 0.14 cm^{-2}. Find the radius of the sphere and initial charge on it.

Q27. Sixty four drops of radius 0.02 m and each carrying a charge of 5μC are combined to form a bigger drop. Find how the surface density of electrification will change if no charge is lost.

Q28 A thin semicircular ring of radius 'a' is charged uniformly and the charge per unit length is λ. Find the electric field at its centre.

Q29. An arbitrary surface encloses a dipole. What is the electric flux through this surface?

Q30. A metallic spherical shell has an inner radius R_1 and outer radius R_2. A charge Q is placed at the centre of the spherical cavity. What will be surface charge density on (i) the inner surface ,and (ii) the outer surface ?

Q31. In 1959, Lyttleton and Bondi suggested that the expansion of the Universe could be explained if matter carried a net charge. Suppose that the Universe is made up of hydrogen atoms with a number density N, which is maintained a constant. Let the charge on the proton be : ^e_p=-(1+y) e where e is the electronic charge.

(a) Find the critical value of y such that expansion may start.
(b) Show that the velocity of expansion is proportional to the distance from the centre.