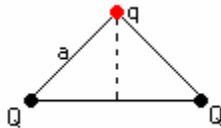


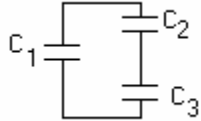
ELECTROSTATICS

1. A wire contains a steady current of 2 A. The number of electrons that pass a cross section in 2s is _____.
2. A conductor is distinguished from an insulator with the same number of atoms by the number of _____.
3. What are the units of $1/4\pi\epsilon_0$?
4. Charges q_1 and q_2 are on the x-axis with q_1 at $x = a$ and q_2 at $x = 2a$. For the net force on another charge at the origin to be zero, how must q_1 and q_2 be related?
5. A particle with a charge of $5 \times 10^{-6} \text{C}$ and a mass of 20g moves uniformly with a speed of 7m/s in a circular orbit around a stationary particle with a charge of $5 \times 10^{-6} \text{C}$. What is the radius of the orbit?
6. What are the units of electric field?
7. Two spheres, one with radius R and the other with 2R, surround an isolated point charge. The ratio of the number of field lines through the larger sphere to be number through the smaller is _____?
8. An isolated point charge produces an electric field with magnitude E at a point 2m away. A point at which the field magnitude is E/4 is _____?
9. A 200 – N/C electric field is in the positive x-direction. The force on an electron in this field is _____.
10. The dipole moment of a dipole is 300-N/C electric field is initially perpendicular to the field, but it rotates so that it is in the same direction as the field. If the moment has a magnitude of $2 \times 10^{-9} \text{ C m}$, find the work done by the field.
11. A point particle with charge Q is at the centre of a Gaussian surface in the form of a cube. The electric flux through any one face of the cube is _____.
12. Charge is distributed uniformly along a long straight wire. The electric field 2 cm from the wire is 20 N/C. What is the electric field 4 cm from the wire?
13. The two charges Q are fixed at the vertices of an equilateral triangle with sides of length a. What is work required to move a from the vertex to the centre of the line joining the fixed charges?

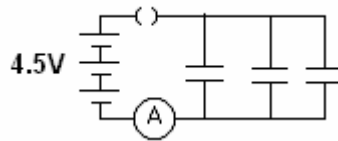


14. If the electric field is in the positive x direction and has a magnitude given by $E = Cx$, where C is a constant. What is the electric potential V?

15. The work in joules required for carrying a 6.0 C charge from a 5.0 V equipotential surface to a 6.0 V equipotential surface and back again to the 5.0 V surface is _____.
16. A parallel-plate capacitor has plate area of 0.2 m^2 and a plate separation of 0.1 mm. If the charge on each plate has a magnitude of $4 \times 10^{-6} \text{ C}$, what is the electric field between the plates of the capacitor?
17. Capacitor C_1 is connected alone to a battery and charged until the magnitude of charge on each plate q_0 . It then removed from the battery and connected to two other capacitors, C_2 and C_3 . How is the charge on the three capacitors related to each other?

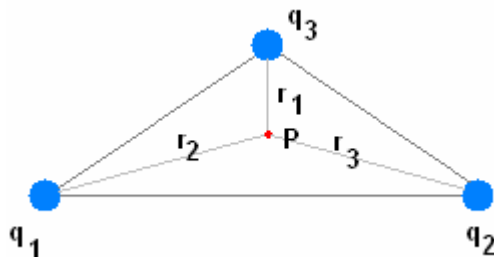


18. Each of three $25 \mu\text{F}$ capacitors are initially uncharged. How many coulombs of charge pass through the ammeter A after the switch S is closed?



19. A certain capacitor has a capacitance of $5 \mu\text{F}$. After it is charged to $5 \mu\text{C}$ and isolated, the plates are pulled apart so its capacitance becomes $2 \mu\text{F}$. What is the work done in pulling apart the plates?
20. One has 2 sheets of copper, sheet of mica ($\chi = 6$, $t = 0.1 \text{ mm}$) sheet of glass ($\chi = 7$, $t = 2 \text{ mm}$), slab of paraffin ($\chi = 2$, $t = 1 \text{ cm}$). To obtain the largest capacitance, which sheet must be placed between the copper sheets.
21. State Coulomb's law. Write SI units of k and ϵ_0 .
22. A metal sphere is suspended from a nylon thread. Initially, the metal sphere is uncharged. When a positively charged glass rod is brought close to the metal sphere, the sphere is drawn toward the rod. But if the sphere touches the rod, it suddenly flies away from the rod. Explain why the sphere is first attracted, then repelled.
23. What similarities do electrical forces and gravitational forces have? What are the most significant differences?
24. Explain the meaning of the following basic properties of electric charge: additivity, conservation, and quantisation.
25. To measure the electric field at a point using a test charge q why is the limit $q \rightarrow 0$ taken?

26. You are given 3 point charges q_1, q_2 and q_3 located at three different points in space. What is the significant difference in method of finding the total electric field and electric potential at a point P in space



27. Answer the following for an electric dipole:
- What is an electric dipole?
 - What is net charge on the dipole?
 - Sketch the electric field lines for the dipole.
 - Place this dipole in an external field \vec{E} at an angle θ with the field. Indicate the direction of the forces on the dipole.
 - Derive the expression for torque experienced by this dipole.
 - Draw the position of dipole for which its potential energy is maximum, minimum and zero. State the value of potential energy for each of these positions.
 - Write the ratio of electric field along axial line to electric field on equatorial plane at a distance r , in both cases.
28. Draw electric field lines for a single positive charge, a single negative charge, two equal positive charges placed at a short distance from each other, 2 unequal negative charges placed at a short distance from each other.
29. Why don't electric field lines cross each other?
30. How do electric field lines give us an idea about the strength of the field?
31. The electric flux is defined as $\vec{E} \cdot d\vec{s}$ where $d\vec{s}$ is an area element.
- How is area defined as a vector?
 - When is flux the maximum?
 - How can the above definition of flux be used to find the total flux through any given surface?
 - According to Gauss's law the electric flux is given by _____?
 - When is the electric flux through a close surface zero?