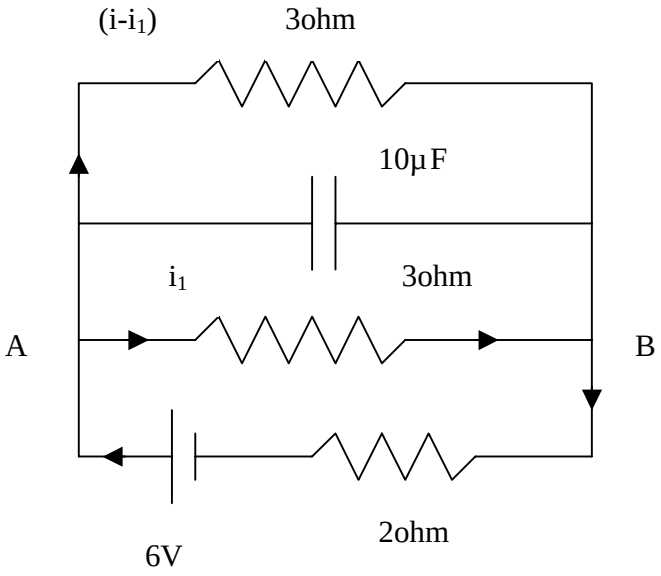
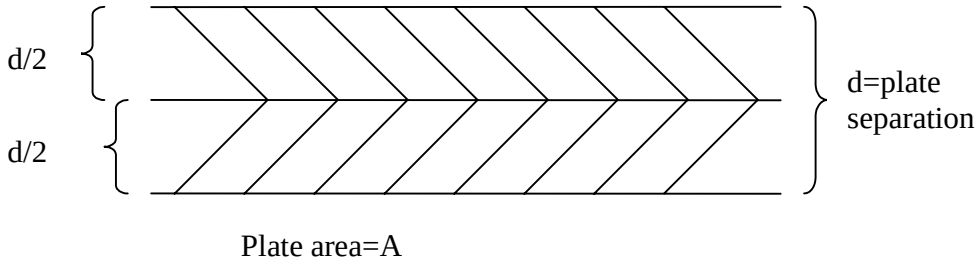
Electrostatics

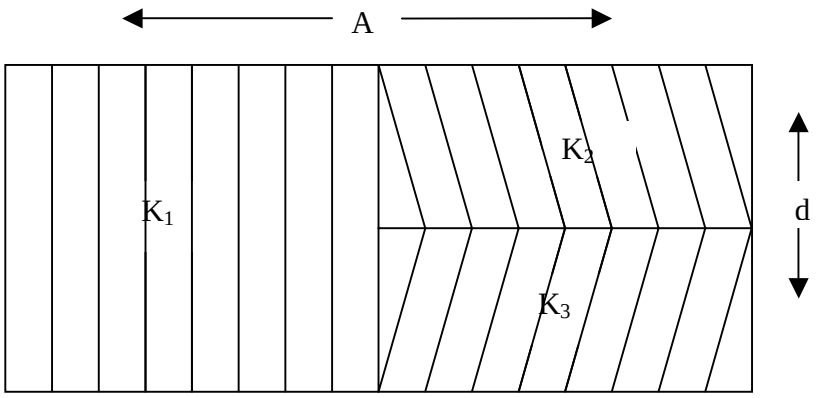
1. Three identical charges each +q are placed at the corners of an equilateral triangle of side d cm. Calculate the force on a +ve charge +2q at the centroid of the triangle.
2. Force acting on a charged particle kept between the pair of plates, having equal and opposite charge, is F. If one of the plates is removed, find the force acting on the same particle.
3. The plates of a parallel plate system are charged upto 100V. A 4mm thickness dielectric slab is inserted between the plates. Then to maintain the same potential difference, the distance between the systems plates is increased by 2mm. find the dielectric constant.
4. A point charge placed at any point on the axis of an electric dipole at some large distance experiences a force F. Find the force acting on the point charge when its distance from the dipole is quadrupled.
5. In the electric field of a point charge 'q', the four points A,B,C and D are equidistant from q, however AB>AC>AD. Calculate the work done in taking a unit charge along AB, AC and AD.
6. N identical spherical drops charged to the same potential 'V' is combined to form a big drop. Find the potential of the new big drop formed.
7. An electron is projected with an initial speed of 25×10^{5} m/s directly towards a proton which is at rest. Initially the electron is supposed to be at a fairly large distance from the proton. Find the distance of the electron from the proton when its instantaneous speed becomes twice the initial speed.
8. Two conducting spheres one of radius 6cm and the other of radius 12cm each carrying 3×10^{-8}C are placed very par apart. If these spheres are connected by a conducting wire, find the direction of motion and the magnitude of charge transferred.
9. A solid metal disc of radius 'R' rotates with constant angular velocity about its axis. Calculate the electric field 'E' at a distance 'x' from the axis and the potential difference 'V' between the centre and the edge of the disc.
10. Three charges of +0.1C each is placed at the corners of an equilateral triangle, 1m side. If energy is supplied at the rate of 1kW, how many days would be required to move one of the charges to the mid point of the line joining the other two?
11. A parallel plate capacitor is made by stacking 'n' equally spaced plates connected alternatively. If the capacitance between any two plates is 'C', determine the resultant capacitance of the combination.
12. A 10μF capacitor is connected in the circuit as shown in figure. Calculate the charge on the capacitor plate.



13. A parallel plate capacitor is filled with two dielectrics as shown in figure. Calculate the capacitance of the system.

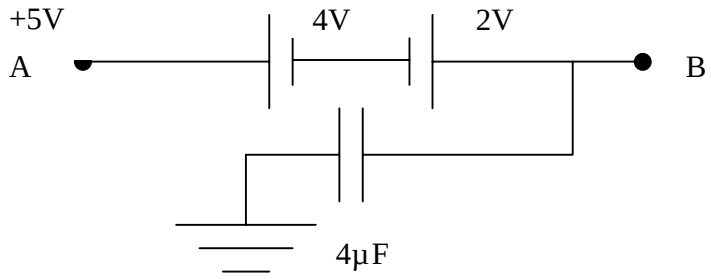


14. A parallel plate capacitor with air as medium has a capacitance of 24μF. The capacitor is filled with three media K_1==6 and K_3=10 as shown in figure. What will be the capacitance of the system?



15. Can a metal sphere of radius 1cm hold a charge of 1coulomb? Justify your answer.

16. What is the p.d across the capacitor and what is the energy stored in the capacitor shown below.



17. If one of the electrons of H_2 molecule is removed we get a hydrogen molecules ion H_2^+.In the ground state of a H_2^+ the two protons are separated by roughly 1.5Å and the electron is roughly 1 Å from each proton. Determine the potential energy of the system.

18. When two capacitors are connected in series, the effective capacitance is 2.4μF and when connected in parallel, the effective capacitance is 10μF. Calculate the individual capacitances.

19. Two fixed charges -2Q and Q are located at the points with co-ordinates (-3a,0) and (+3a,0) respectively in the x-y plane. Show that all the points in the x-y plane where the electric potential due to the two charges is 0, lie on a circle. Find its radius and location of its centre.

20. Two square metallic plates of side 1.5m are kept 0.015m apart like a parallel plate capacitor, in air in such a way that one of their edges is perpendicular to an oiled surface in a tank filled with insulating oil. The plates are connected to a battery of EMF 600V. The plates are then lowered vertically into the oil at a speed of 0.002m/s. Calculate the current drawn from the battery during the process(dielectric constant of oil=12, $\varepsilon = 8.85 \times 10^{-12}$ SI Units)

21. A charged particle is free to move in an electric field. Will it always move along the electric lines of force?

22. Two point charges '+q' and '-q' are placed at a distance'd' apart. What are the points at which the resultant field is parallel to the line joining the two charges?

23. Two copper spheres of same radii, one hollow and the other solid are charged to the same potential. Which of the two will have same charge?

24. You are given three capacitors of value 2μF, 3μF, 6μF. How will you connect them to a resultant capacity of 4μF?

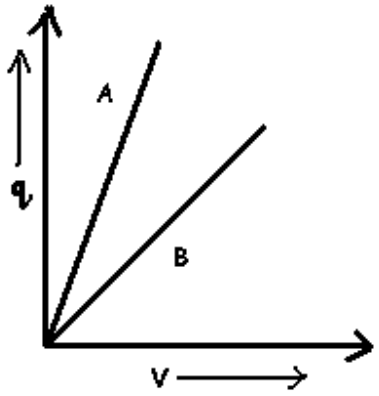
25. Can you create an electric field in which all the lines of force are parallel but their density increases continuously in a direction perpendicular to the lines of force? Give reason.

26. Can you suggest an arrangement of three point charges separated by some finite distance that has zero electric potential energy?

27. Calculate the work done by the electric field of the nucleus in a complete circular orbit of an electron. Is their any change in this work if the orbit is elliptical?

28.The given graph shows the variation of charge 'q' verses potential difference for two capacitors C_1 and C_2 .The capacitors have same plate separation, but the

plate area of C_2 is double that of C_1.Identify the line in the graph corresponding to C_1 & C_2 and why?



29.Two identical charged spheres are suspended in air by strings of equal lengths and make an angle of 60^0 with each other. When suspended in a liquid of density 0.4g/cc,the angle remains the same. What is the dielectric constant of the liquid? Density of the material of the sphere=0.8g/cc.

30.Two deutrons are separated by a distance 'r' metre and have coulomb force=F. If two alpha particles are separated by a distance of 2r metre, find the force between the alpha particles.

31.Eight dipoles of charges of equal magnitude are placed inside a cube. Calculate the total electric flux coming out of the cube.

32.An inflated balloon is charged by rubbing with fur. Will it stick readily to a conducting wall or to an insulating wall? Give reason.

33.An electron moves a distance of 6cm when accelerated from rest by an electric field of strength $2x10^{-4}$ N/C. Calculate the time of travel. Given $m_e=9x10^{-31}$kg, $e=1.6x10^{-19}$C.

34.Is the capacitance of a capacitor proportional to the charge Q ? Sketch a graph to show how the capacitance C of a capacitor varies with the charge Q given to it.