Class - XII

(Electric potential and capacitance)

Q1) Define electric potential and potential difference. Write their S.I unit.

Q2) Derive an expression for electric potential due to a point charge.

Q3) Draw graphical variation of electric potential (V) and electric field intensity (E) with r for a point charge q.

Q4) Derive the expression for electric potential due to electric dipole in following cases

(i) At axial line

(ii) At equitorial line

(iii) At a general point.

Q5) Write expression for the electric potential due to uniformly charged spherical shell at a point (i) outside the shell (ii) on the shell and (iii) inside the shell. Represent it graphically

Q6) Twenty seven drops of same size are charged at 220V each. They coalesce to form a bigger drop. Calculate the potential of the bigger drop

Q7) A charge Q is distributed over two concentric hollow spheres of radii r and R, where $R > r$, such that the surface charge densities are equal. Find the potential at the common centre.

Q8) Three concentric metallic shells A, B and C of radii a, b and c ($a < b < c$) have surface charge densities $+\sigma$, $-\sigma$ and $+\sigma$ as shown in fig.

(i) find the potential of three shells A, B and C.

(ii) If shells A and C are at the same potential, obtain the relation between radii a, b and c.

Q9) Show that the electric field at any point is equal to the negative of the potential gradient at that point.

Q10) The electric field in a region is given by $\vec{E} = \frac{A}{x^3}\hat{i}$, write the S I unit of A. Write an expression for the potential in the region assuming the potential at infinity to be zero.

(Q. 11) A Uniform electric field of 30 N/C exists along the x axis.

calculate the potential difference $V_B - V_A$ between the points A (4m, 2m) and B (10m, 5m).

Q.12) What are equipotential surfaces. Write their important characteristics.

Q.13) Draw the equipotential surfaces in following cases:

(i) Equipotential surfaces due to a point charge.

(ii) Equipotential surfaces due to an electric dipole.

(iii) Equipotential surfaces due to two equal point (positive) charges.

(iv) equipotential surfaces due to uniform electric field.

Q.14) What is significance of equipotential surfaces.

Q.15) Derive the expression of electric potential energy due to

(i) two charge system

(ii) three charge system.

Q.16) Define electric potential energy. Write the expression for electric potential energy of n charge system.

Q.17) Derive an expression for the potential energy of a dipole in a uniform electric field. Discuss the conditions of stable and unstable equilibrium.

Q.18) Find the electrostatic potential energy of the configuration of four charges $+q$, $-q$, $+q$ and $-q$ at the four corners A, B, C and D of a square of side a.

Q.19) State the various electrostatic properties by conductors placed in electrostatic fields.

Q.20) What is electrostatic shielding. Write its applications.

Q.21) Define electric capacitance Write its S-I unit.

Q.22) 125 drops of water each of radius 2mm and Carrying change of 1nc are made to form a bigger drop. Find the capacitance of the bigger drop.

Q20) Obtain the expression for the capacitance of an isolated spherical conductor of radius R.

Q21) Explain the principle of capacitor.

Q22) Derive an expression of capacitance of a parallel plate capacitor. On what factors does the capacitance of a parallel plate capacitor depend?

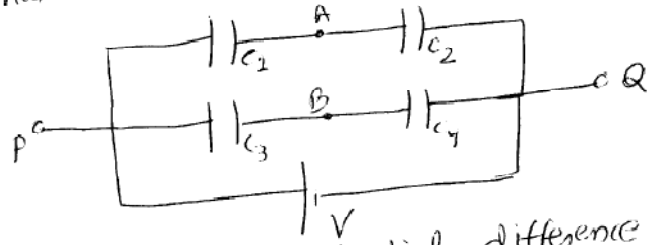
Q24) A charge of 2×10^{-8} C is placed on the positive plate and a charge of -1×10^{-8} C on the negative plate of a parallel plate capacitor of capacitance 1.2×10^{-3} μF. Calculate the potential difference developed between the plates.

Q27) When the potential difference across a capacitor is reduced by 120 V, the charge on the capacitor changes from 360 μC to 120 μC. What is capacitance of the capacitor.

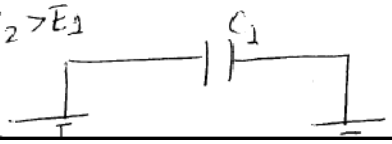
Q28) A number of capacitors are connected in series combination. Derive the expression of their net capacitance.

Q29) A number of capacitors are connected in parallel combination. Derive the expression of their net capacitance.

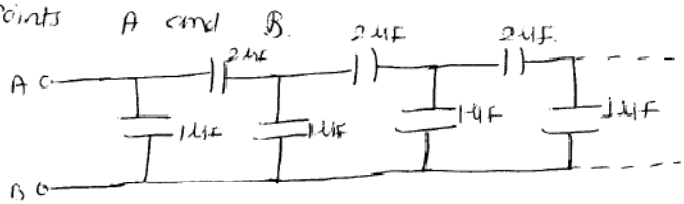
Q30) Determine the potential difference $V_A - V_B$ between points A and B of the circuit shown in figure. Under what conditions is it equal to zero.



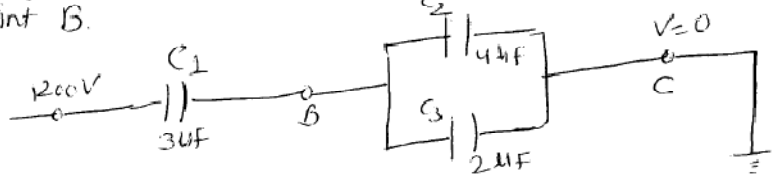
Q31) Determine the potential difference across the plates of each capacitor of the network shown in fig. Take $E_2 > E_1$



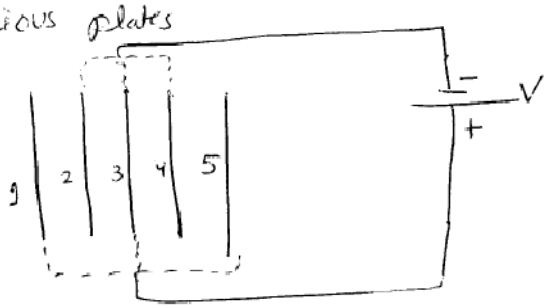
Q32) Find the equivalent capacitance of the ladder between points A and B.



Q33) In the circuit shown in fig, If the point C is earthed and point A is given a potential of +1200V, find the charge on each capacitor and the potential at the point B.



Q34) Five identical capacitor plates, each of area A are arranged such that the adjacent plates are at distance d apart. The plates are connected to a source of emf V, as shown in figure. Find the charges on the various plates

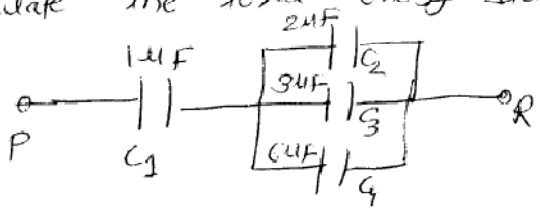


Q35) Derive the expression for energy stored in between the plates of capacitor. Derive the expression of energy density of an electric field.

Q36) If two charges are touched mutually and then separated, prove that the charges on them will be divided in the ratio of their capacitances.

Q37) Derive the expression for energy loss when two capacitors having different capacities and different potentials are joined together.

Q33) In figure, the energy stored in C_4 is 27 J. Calculate the total energy stored in the system.



Q39) Define electric susceptibility. Deduce the relation between dielectric constant and electric susceptibility.

Q40) What do you mean by dielectric strength of a dielectric.

Q41) Deduce the expression for a parallel plate capacitor when a dielectric slab is inserted in between the plates of capacitor.

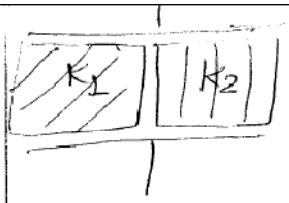
Q42) Deduce the expression for a parallel plate capacitor when a conducting slab is inserted in between the plates of capacitor.

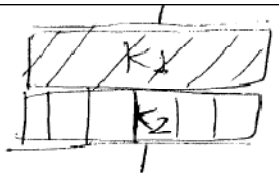
Q43) Mention any three uses of capacitor.

Q44) A parallel plate capacitor is charged by a battery which is then disconnected. A dielectric slab is then inserted to fill the space between the plates. Explain the changes, if any, that occur in the values of (i) charge on the plates, (ii) electric field between the plates (iii) P.D between the plates (iv) capacitance (iv) energy stored in the capacitor.

Q45) A parallel plate capacitor is charged by a battery. When battery remain connected, a dielectric slab is inserted between the plates. Explain what changes, if any, occur in the values of (i) P.D between the plates, (ii) electric field between the plates (iii) capacitance (iv) charge on the plates and (v) energy stored in the capacitor.

Q46) Find the ratio of the capacitances of a capacitor filled with two dielectrics of same dimensions but of dielectric constant k_1 and k_2, respectively.





Q47) The insulated plates of a parallel plate capacitor has a charge density σ. Show that the work done in changing the distance from d_1 to d_2 is

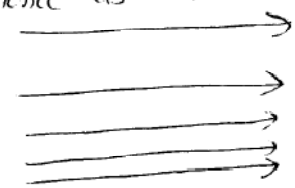
$$U = \frac{\sigma^2 A}{2\varepsilon_0 K}(d_2 - d_1)$$

Q48) draw the lines of force between the plates of a charged parallel plate capacitor.

Q49) Sketch a graph to show how the capacitance C of a capacitor varies with the charge Q given to it.

Q50) Sketch a graph to show how the charge Q acquired by a capacitor of capacitance C varies with increase in potential difference between its plates.

Q51) Is it possible to have electric field in which all the lines of force are parallel lines and whose density increases gradually in a direction perpendicular to the lines of force as shown in figure



Q52) The electric potential as a function of distance x is shown in figure. construct a graph of the electric field strength E