CHAPTER-2

Electrostatic Potential and Capacitance

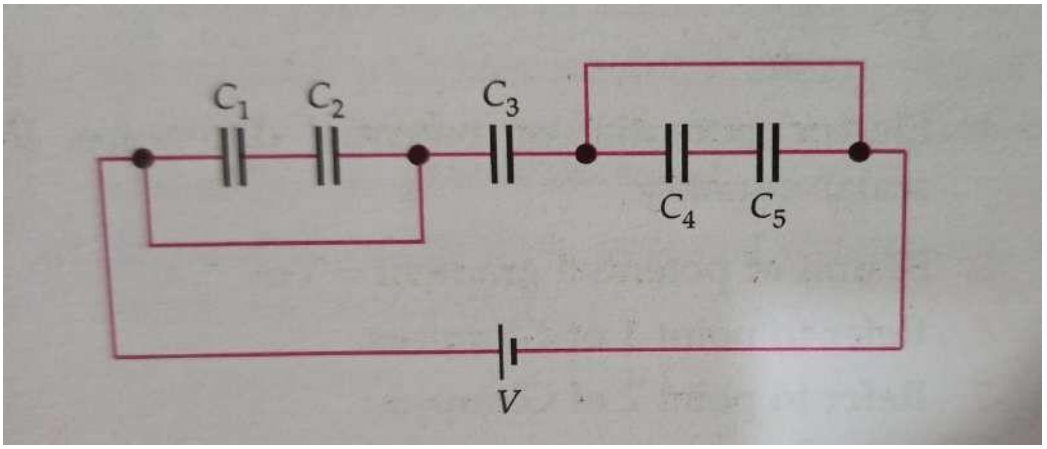
ASSIGNMENT-2

1 MARK QUESTIONS

Q1. An air capacitor is given a charge of 2μC raising its potential to 200 V. If on inserting a dielectric medium, its potential falls to 50 V. What is the dielectric constant of the medium.

Q2. A parallel plate capacitor with air between the plates has a capacitance of 8pF. What will be the capacitance if the distance between the plates by reduced by half and the space between themis filled with a substance of dielectric constant k =6.

Q3. What is the equivalent capacitance, C, of the five capacitors connected as shown in the figure



ASSERTION – REASON QUESTIONS

Directions: These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.

(a) Both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) Both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) Assertion is correct, Reason is incorrect

(d) Both Assertion and Reason are incorrect.

Q4 **Assertion:** A spherical equipotential surface is not possible for a point charge.

Reason: A spherical equipotential surface is not possible inside a spherical capacitor.

Q5**.Assertion:** The equatorial plane of a dipole is an equipotential surface.

Reason: The electric potential at any point on equatorial plane is zero.

Q6**.Assertion:** Electric potential and electric potential energy are different quantities.

Reason: For a system of positive test charge and point charge electric potential energy = electric potential.

Q7.**Assertion:** Two equipotential surfaces cannot intersect each other.

Reason: Two equipotential surfaces are parallel to each other.

Q8. Assertion : If the distance between parallel plates of a capacitor is halved and dielectric constant is three times, then the capacitance becomes 6 times.

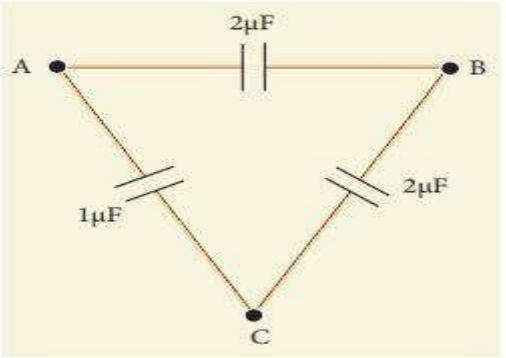
Reason : Capacity of the capacitor does not depend upon the nature of the material.

Q9**. Assertion** : A parallel plate capacitor is connected across battery through a key. A dielectric slab of dielectric constant K is introduced between the plates. The energy which is stored becomes K times.

Reason : The surface density of charge on the plate remains constant or unchanged.

MULTIPLE CHOICE QUESTIONS

Q10. Three capacitors are connected in triangle as shown in the figure. The equivalent capacitance between the points A and C is



(a) 1μF

(b) 2 μF

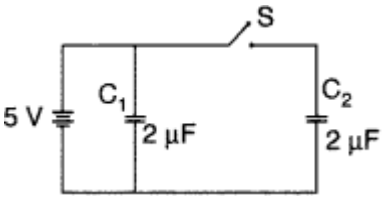
(c) 3 μF

(d)1/4μF

1 MARKS QUESTIONS

Q11.If two charged conductors are touched mutually and then separated, prove that the charges on them will be divided in the ratio of their capacitances.

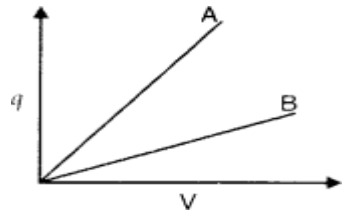
Q12. Figure shows two identical capacitors C_1 and C_2, each of 2 μF capacitance, connected to a battery of 5 V. Initially switch 'S' is left open and dielectric slabs of dielectric constant K = 5 are inserted to fill completely the space between the plates of the two capacitors.



(i) How will the charge and

(ii) potential difference between the plates of the capacitors be affected after the slabs are inserted?

Q13. The given graph shows variation of charge 'q' versus potential difference 'V' for two capacitors C_1 and C_2. Both the capacitors have same plate separation but plate area of C_2 is greater than that of C_1. Which line (A or B) corresponds to C_1 and why?



Q14. A metal plate is introduced between the plates of a charged parallel plate capacitor. What is its effect on the capacitance of the capacitor.

Q15. Two capacitors have a capacitance of 5μF when connected in parallel and 1.2μF when connected in series. Calculate their capacitances.

Q16. Why does current in a steady state not flow in a capacitor connected across a battery? However momentary current does flow during charging or discharging of the capacitor. Explain.

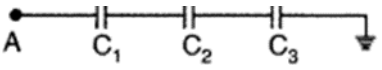
Q17. A capacitor is connected across a battery.

(i) Why does each plate receive a charge of exactly the same magnitude?

(ii) Is this true even if the plates are of different sizes?

2 MARKS QUESTIONS

Q18. Calculate the potential difference and the energy stored in the capacitor C_2 in the circuit shown i the figure. Given potential at A is 90 V, C_1 = 20 μF, C_2 = 30 μF and C_3 = 15 μF.



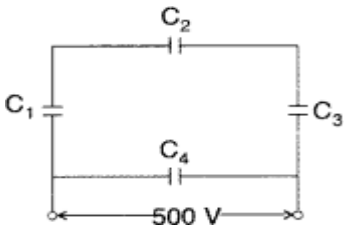
Q19. A capacitor of unknown capacitance is connected across a battery of V volts. The charge stored in it is 300 μC. When potential across the capacitor is reduced by 100 V, the charge stored in it becomes 100 V. Calculate the potential V and the unknown capacitance. What will be the charge stored in the capacitor if the voltage applied had increased by 100 V?

Q20. A parallel plate capacitor, of capacitance 20pF, is connected to a 100 V supply. After sometime the battery is disconnected, and the space, between the plates of the capacitor is filled with a dielectric, of dielectric constant 5. Calculate the energy stored in the capacitor

(i) before

(ii) after the dielectric has been put in between its plates.

Q21. A network of four capacitors each of 12μF capacitance is connected to a 500 V supply as shown in the figure.



Determine

(a) equivalent capacitance of the network and

(b) charge on each capacitor.

Q22. A parallel plate capacitor is charged by a battery to a potential difference V. It is disconnected from battery and then connected to another uncharged capacitor of the same capacitance. Calculate the ratio of the energy stored in the combination to the initial energy on the single capacitor.

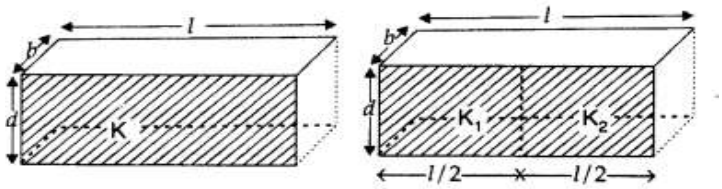
5 MARKS QUESTIONS

Q23. a) Explain, using suitable diagrams, the difference in the behavior of a

(i) conductor and

(ii) dielectric in the presence of external electric field. Define the terms polarization of a dielectricand write its relation with susceptibility.

Q24. Two identical capacitors of plate dimensions l × b and plate separation d have di-electricslabs filled in between the space of the plates as shown in the figure.



Obtain the relation between the dielectric constants K, K_1 and K_2.

Q25. A parallel plate capacitor of capacitance C is charged to a potential V by a battery. Without disconnecting the battery, the distance between the plates is tripled and a dielectric medium of k = 10 is introduced between the plates is tripled and a dielectric medium of k = 10 is introduced between the plates of the capacitor. Explain giving reasons, how will the following be affected:

(i) capacitance of the capacitor

(ii) charge on the capacitance.